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A National Environmental/Energy Workforce Assessment. Indiana

National Field Research Center, Inc, Iowa City, Iowa

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A National Environmental/Energy Workforce Assessment

INDIANA

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16. ABSTRACT

This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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for

INDIANA

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC

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1977

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PREFACE

This study provides information on existing workforce levels, training programs, and career potentials and develops workforce projections (1976-1982) for the environmental pollution control fields of air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy conservation/conversion in the State of Indiana. The profiles and projections contained in this report were based upon available information obtained through various state agencies. The information and data presented in this study were obtained through extensive personal interviews with professionals working in the respective fields. The personal interviews were supplemented with information collected through telephone surveys and research.

This study was conducted under the direction of the United States Environmental Protection Agency by National Field Research Center, Inc., located in Iowa City, Iowa.

FOREWORD

The materials contained in this report include information and data collected on eight individual pollution control inventories conducted for Indiana. The format includes workforce profiles, projections, and career potential for each of the areas investigated. Projections were necessarily based on best professional estimates obtained through available information. The pollution control areas considered by this study are as follows:

Air
Noise
Pesticides
Potable Water
Radiation
Solid Waste
Wastewater
Energy

National Environmental Energy Workforce Assessment

Phase I

INDIANA

State Summary

I. AIR

Indiana ranks among the nation's top ten manufacturing states. With the numerous benefits accrued through this industrialization, the state has experienced varied and significant air pollution problems. The state recognized the need for monitoring and control of the emerging air pollution problems as early as 1961. During 1961, the Indiana Air Pollution Control Law was adopted. In 1962, the Indiana Air Pollution Control Division, an office of the Indiana State Board of Health, was created and delegated the administrative responsibility for air pollution control activities.

The Air Pollution Control Division is currently staffed with 101 positions: 86 professionals and 15 clerical. The professional staff members represent a variety of disciplines, including engineering, sciences, law, computer science, and electronics. The Division predicts an average annual growth rate of 8% through 1981. The greatest increase will be in the legal and engineering categories.

Some of the responsibility for air pollution control has been delegated to the ten local air pollution control agencies. The local agencies have a cumulative professional staff of 55 members. The professions represented include engineering, law, physical and research science, and technical trades. Minimal growth is estimated for the local agencies through 1981. A maximum growth of 4% per annum is projected. The most significant growth will occur in the legal and scientist categories.

II. NOISE

Industrial/Environmental noise control and abatement activities within Indiana are emerging. During 1976, there was a one hundred percent increase in the number of complaints filed concerning industrial noise. Noise control activities have been delegated to the Indiana State Board of Health.

The Board of Health currently employs two persons whose responsibilities include follow-up on community/environmental noise complaints. These two persons have a background in industrial hygiene and have been providing technical assistance to municipalities in the development of noise ordinances. It is estimated that less than one-half person-year is devoted to community and environmental noise activities. The Board anticipates an expanded interest in noise control during the next five years. In response to this demand, the Board is requesting two additional positions for the coming year (1977). It is hoped that these two positions will be filled by engineers with some experience in noise and acoustics. Addditional positions may be required to meet the expanding need for noise control; however, additional projections are not currently available.

Municipalities and private industries within Indiana have relatively underdeveloped noise control programs. Six cities currently have operational noise programs. These programs are frequently operated through the police department. Generally, one police officer has been delegated responsibility for the program.

III. PESTICIDES

The Indiana Office of the State Chemist and Seed Commissioner is the principal pesticide regulation and control unit within the state. Until recently, the Office has been primarily concerned with product registration and product quality; however, late in 1975, the Office became the lead agency for the coordination of pesticide applicator certification.

The Office of the State Chemist is currently staffed by 15 professionals: 13 chemists and 2 entomologists. Four of the 15 staff members are directly involved with the applicator certification program. Five additional positions are planned for the certification program. These positions are likely to be filled by persons with experience in chemistry, entomology, or a related science. Staffing levels for the pesticide program are estimated to remain stable through 1982; however, more accurate projections of staffing requirements will be available after the program has been in operation for a full year.

Information of pesticide-related occupations within the private sector is limited. It is estimated that there are 35,000 to 105,000 farmers within the state who will seek certification as private pesticide applicator. There are an additional 7,000 to 8,000 licensed operators, licensed applicators, licensed public applicators and other certified commercial applicators who will require commercial certification. No projections can be made on growth or decline within the private sector.

IV. POTABLE WATER

The Public Water Supply Section of the Division of Sanitary Engineering is the principal potable water classification and surveillance section within the Indiana State Board of Health. The primary goal of the Section is to ensure that all public water supplies are continuously operated and maintained.

The Public Water Supply Section employs 11 professionals and 3 clerical persons. The professionals include nine engineers and two water works supervisors. The Section expects to grow by about 200% over the next five years. The greatest growth will be in the engineer and sanitarian categories. This growth is related to enforcement activities under the Safe Drinking Water Act.

The Water and Sewage Laboratory of the State Board of Health provides laboratory support to the Section. Approximately 8.5 person years of support is provided annually. The staffing requirements for the Laboratory are expected to increase by 10% annually over the next five years. The growth will occur in both the chemist and microbiologist category.

Experts within the state indicated that there may be in excess of 2,500 persons actively employed in public water supply systems in Indiana. During the next five years there will be some growth in the number of persons employed in the municipal water supply systems. It is estimated that there will be an average annual increase of 50 new employees requiring certification annually: 35 of the 50 will be operators. Growth will occur due to expansion and upgrading of existing facilities.

V. RADIATION

Within the State of Indiana, the environmental radiation and radiological health programs are administered by the Radiological Health Section of the Division of Industrial Hygiene and Radiological Health. The primary goal of the Section has been to improve the control of harmful radiation effects to the citizens of Indiana.

The Radiological Health Section is currently staffed with six professionals and one and one-fourth clerical positions. The professional positions include two health physicists, three sanitarians, and one part-time administrator. During the past two years, the Section has experienced a sudden growth. This increase has been brought about by the state seeking NRC "agreement state" status. Optimistic estimates indicate that the state will achieve this status within three years. The Section has requested an additional eight staff positions, all radiation health physicists, for the next fiscal year (1977); however, the Section estimates that four of the positions will be funded. If activities in the department continue to expand, additional staff members may be required.

Workforce statistics for the "radiation control" occupations within the private sector are nebulous. Professional estimates indicated that universities, hospitals, and physicians/dentists account for a major segment of the private sector radiation programs. Increases within the private sector are expected to be minimal during the next five years.

VI. SOLID WASTE

The Solid Waste Management Section of the Indiana State Board of Health has the overall administrative responsibility for the state's solid waste program. The primary role of the program is to provide technical assistance, planning assistance, surveillance/ enforcement activities, and operator training.

The Solid Waste Management Section is currently staffed by twelve professionals: 3 engineers, 8 sanitarians, and 1 research scientist. The Section will experience a steady growth over the next five years. The Section predicts a 35% per annum growth, with the greatest demand occuring in the engineer and sanitarian categories. The subsection experiencing the greatest growth rate will be the Hazardous Waste Program.

There are currently 126 sanitary landfills in the state. There are approximately 100 landfill supervisors and an estimated 400-450 landfill operators. In addition, it is estimated that there are 114 gate attendants, 71 mechanics, and 16 weighmasters employed at the sites. A recent survey conducted by the Board of Health revealed that there are approximately 736 employees in collection systems in the state. Hazardous wastes are currently accommodated within sanitary landfills, and there are no existing resource recovery programs. The sanitary landfill workforce is expected to increase a minimum of 5% annually over the next five years. The collection system workforce is also expected to experience a slight increase averaging 5% per annum. A resource recovery program staffed with 15 professionals is planned for the next two years.

VII. WASTE WATER

The Water Pollution Control Division of the Indiana State Board of Health administers the Municipal Construction Grant Program, NPDES Permit Program, the Oil and Hazardous Materials Spill Response Program, and the Area-Wide Section 208 Planning Program. The Water and Sewage Laboratory provide supportive services to the Division in the analysis of waste water samples.

The Water Pollution Control Division has 122 full-time authorized positions; however, only 112 of those professional positions are currently filled. The professional positions include engineers, sanitarians, attorneys, planners, administrators, biologists, and sewage works supervisors. Over the next five years the Division will experience substantial growth, with an average annual rate of 13%. Implementation of PL 92-500 will have the greatest single impact upon the staffing of the Division.

There are 110 Class I, 120 Class II, 54 Class III, and 28 Class IV waste water treatment facilities in the state. These facilities are currently staffed with 1,751 full-time and 430 part-time employees. These figures include operators, maintenance personnel, laboratory personnel, laborers, supervisory and other. The Water Pollution Control Division anticipates up to a 300% increase in the number of employees in the waste water treatment facilities during the next five years.

VIII. ENERGY

Indiana, as one of the top ten industrial states, has a major interest in energy production. While the state has a designated energy office, the Indiana State Energy Office, the Office has had limited responsibilities. The primary emphasis of the Office has been public relations and administering the federal mandatory petroleum allocation program.

The State Energy Office is currently staffed with five professional and two clerical positions. Two of the professionals are basic administrative positions, a third position is responsible for the Governor's Pride Program, a fourth has delegated responsiblity for solar energy, and the fifth professional is administering the mandatory petroleum program.

During the past year, two positions were eliminated from the staff due to budget reduction. However, with the immediate need to resolve many of the energy related problems facing the state, the Office is expected to grow slowly during the next five years. The Office predicts that three positions will be added to the Office during the coming five years: a librarian, an engineer, and a computer scientist.

Limited information is available on private sector workforce projections; however, the construction of two nuclear power plants in the state will have a measurable impact upon private sector energy related occupations.

STATE OF INDIANA - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR	1,468	1,594	1,685	1,760	1,868	1,989	6%
NOISE[1]	1	2	2	2	2	2	n/a
PESTICIDES[2]	15	19	19	19	19	19	n/a
POTABLE WATER[3]	30	43	53	69	71	75	n/a
RADIATION[4]	6	10	10	12	14	14	n/a
SOLID WASTE[5]	1,449	1,529	1,650	1,735	1,827	1,922	6%
WASTEWATER[6]	2,293	3,173	4,068	4,934	5,824	6,701	24%
ENERGY[7]	7	7	7	9	10	10	n/a
TOTALS	5,269	6,377	7,494	8,540	9,635	10,732	15%

[1] The above does not include the estimated 800 safety officers with some noise-related responsibility.

[2] This figure includes only state staff; it does not include the 105,000 farmers, 7,000 to 8,000 licensed operators, licensed applicators, licensed public applicators, and other certified commercial applicators, or the 800 to 1,000 pesticide dealers. No information was available on the growth in these categories.

[3] The above does not include the more than 2,500 persons employed in public water systems.

[4] These figures do not include information on the private sector.

[5] These figures do not include any statistics on the resource recovery field.

[6] Each of the above estimates includes 19% part-time employees.

[7] The above figures do not include information on the private sector.

EDUCATION

The educational institutions in Indiana offer a wide variety of environmental education programs. While many of the colleges and universities in the state offer environmentally related programs, there are several notable programs. Ball State University, located in Muncie,offers programs on both the undergraduate and graduate level. Ball State also has an operable Institute for Environmental Studies.

Graduate degrees in environmental studies are also available through the School of Public and Environmental Affairs. The School is a multi-campus programs. The program is currently available through the Indiana University campuses located in Bloomington, Indianapolis, Northwestern, Fort Wayne, and South Bend. Degrees available through the School include A.S., B.S., M.S., M.P.A., and Ph.D.

The University of Evansville, the University of Notre Dame, and Purdue University also have well developed environmental programs on the Bachelor of Science level.

Indiana Vocational Technical Schools, the Indiana Community College System, offers a number of certificate, A.S. degree, and community education programs. The Pollution Treatment Technology Program, an Associate in Science program available through the Gary Campus,is particularly outstanding. A comprehensive community education environmental technology program is being coordinated through the Gary Campus.

LEGISLATION

The environmental/energy legislation for Indiana was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Environmental Management Act

Environmental Law

Air Pollution Control Law

Pesticide Use and Application Law

Pesticides Law

Certification of Water and Waste Water Treatment Plant Operators Law

Radiation Control Act of Indiana

Refuse Disposal Act

Litter Control Law

Abandoned Vehicle Act

Highway Junkyard Control Act

Confined Feeding Control Law

Phosphate Detergent Law

Indiana Stream Pollution Control Law

National Environmental Energy Workforce Assessment

Phase I

INDIANA

State Report

13

STATE PROFILE

Indiana, though officially classified as an east north central state of the United States, is perhaps the most Southern in character of all the Northern states. Indiana's 36,291 square miles make it, except for Hawaii, the smallest state west of the Appalachian Mountains. It had a population of 5,193,669 in 1970, with seven percent black and 65 percent urban.

Indiana has four distinct seasons and a temperate climate, usually escaping extremes of cold and heat. Annual precipitation ranges from 44 inches in the south central region to 35 inches in the north. Fall is perhaps the most beautiful of all the seasons with colors provided by maples, oaks and a wide variety of other trees. The steady growth of agriculture, cities, and industry and the consequent environmental pollution have, however, taken a toll on the natural beauty of the state. Air and water pollution are particularly severe along the southern tip of Lake Michigan.

The three major regions of Indiana are: the industry and truck gardening of the flat northern region; the fertile central plains; and the less fertile but forested large southern region. The northern section of the state lies in the mainstream of the great industrial belt stretching from Pennsylvania and New York State westward to Chicago. The northwestern cities form an industrial, economic, and social continuum with neighboring Chicago. Southwest to the Wabash Valley are rich farmlands, obtained largely by draining and deforesting marshes.

To the east, South Bend is an important manufacturing and educational center.

Indiana is one of the states most preferred by companies planning to build or relocate industrial facilities. Studies indicate that Indiana is preferred because of the availability of labor and essential materials, as well as the fact that the state is located within 800 miles of 40 of the nation's largest consumer and industrial markets. The personal income of the state is above the national average, and unemployment rarely exceeds the national figure.

Indiana leads the nation in the production of building stone, quarried in the Bedford-Bloomington region. Bituminous coal from the southwest is the state's leading commodity for heating and generating electrical power.

Since the 1850's, manufacturing has gradually become the dominant source of income for the state, with the steel industry a major component. Overall, Indiana ranks among the nation's top ten states in manufacturing which accounts for 40 percent of the state's labor force. Indiana is also considered a highly agricultural state, ranking near the top nationally in cash receipts from farm marketing. Major crops include corn, soybeans, and wheat. Hogs are the principal animal agricultural product, with cattle, sheep, and poultry becoming increasingly important.

INDIANA POLLUTION CONTROL AND ABATEMENT AGENCIES

The principal environmental agency is the Environmental Management Board, having jurisdiction in the areas of Air Quality, Water Quality, Radiation, Odor, Noise and Solid Waste. Specific responsibilities are delegated to the Air Pollution Control Board and Stream Pollution Control Board. The Indiana State Board of Health, headquartered in Indianapolis, provides the budget and staff for these environmental programs. The Board of Health is divided into three program areas: Environmental Health, Medical Operations and Administration. The pollution control and abatement offices are, for the most part, located within the Environmental Health Program.

The Environmental Health Program is subdivided into four divisions under a Bureau of Engineering: Air Pollution Control, Industrial Hygiene and Radiological Health, Sanitary Engineering, and Water Pollution Control. These four divisions are, in turn, divided into sections; the sections are the fundamental operational units within each division. In addition to these four divisions, the Water and Sewage Laboratory, a division of the Medical Operations Program, provides laboratory support to the Public Water Supply and Water Pollution Control Programs. The Pesticide Control and Registration Program is operated by the Indiana State Chemist's Office located at Purdue University, West Lafayette, Indiana.

The general functions of the Environmental Health Program include:

1) evolving policies for comprehensive environmental development and control on a statewide basis;

2) unifying, coordinating and implementing programs to provide for the most beneficial use of the resources of the state;

3) preserving, protecting and enhancing the quality of the environment for future generations.

Excluding the pesticide control program, the Environmental Health Program (plus the Water and Sewage Laboratory) is staffed with 240 professional, technical and administrative personnel (August, 1976). The total staffing level of these programs is 285, 255 professional, 6 technical, 9 administrative, and 45 clerical. Annual turnover for these positions averages 12% for professionals, 10% for technical, and 5% for clerical. Turnover for the administrative category is minimal.

During the last fiscal year, the staffing of the environmental program has experienced a 22% growth in positions, primarily in the Air and Water Pollution Control programs. The overall turnover rate for the program averaged 14%. An organizational chart for the Indiana State Board of Health is included to illustrate the inter-relationship of the Environmental Health Program to the other health programs.

During the next five years, one of the primary program goals for the Indiana State Board of Health is to gain "agreement state" status under the Nuclear Regulatory Commission program. The Radiological Health Section tentatively believes that it will be eligible for "agreement state" status in no more than three years. Becoming an agreement state will have a major impact both upon the staffing and the function of the department.

The Public Water Supply Program is also expected to expand over the next five years. The program is currently staffed by 11 professionals and may grow to 46 full-time professionals during the next five years. The anticipated annual growth rate is 29%. This increase in the department has been attributed to the increase in enforcement activities under the Safe Drinking Water Act.

In addition to the 240 professionals in the Environmental Health Program, there are an additional 15 professional employees in the Office of the State Chemist. The office is the primary pesticide registration and control agency in the state. While the office has been charged with the responsibility for the pesticide applicator certification program, little growth within the department is expected over the next five years.

The Office of the Attorney General provides legal enforcement to the Environmental Health Program. The Attorney General's Office has an environmental division which is the advocacy and enforcement arm of the Board of Health. The office is involved only with litigation. They do not have the authority to initiate any action through their own volition; all actions must be referred to them by the various boards having jurisdiction. The environmental division is currently staffed with four attorneys. During the last fiscal year, one attorney left the department and was replaced. There is no apparent plan for expansion of the division.

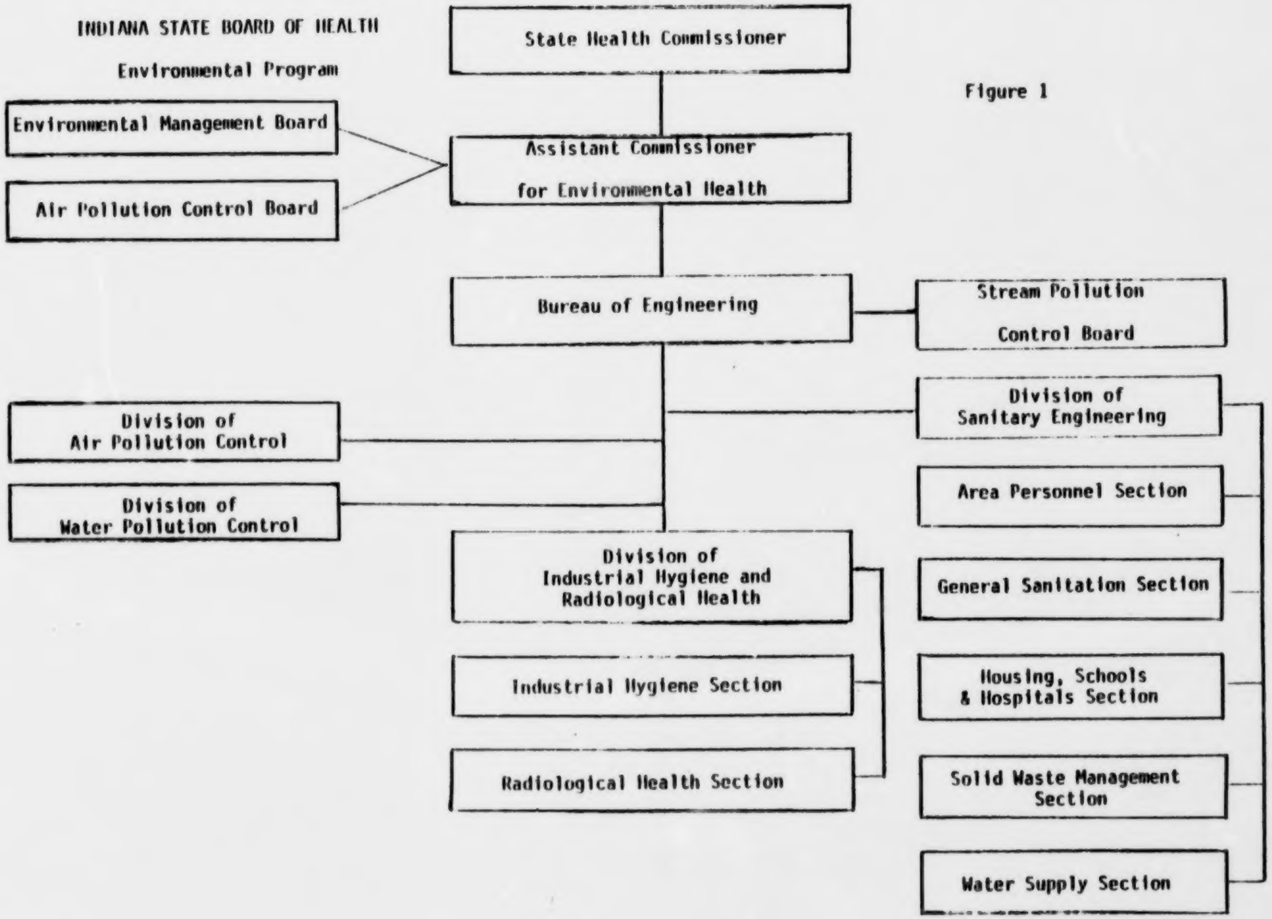
Within the State of Indiana, the general thrust of energy programs has been in public relations. The State Energy Office and the Governor's Office have been involved in certain aspects of energy conservation. The Governor's Office has sponsored a community conservation public relations program, the Governor's Pride Program. The State Energy Office has also been involved with public relations programs to encourage individual and community conservation programs. In addition, the office has also been active in the mandatory petroleum conservation program. During the next five years, there may be a major reorganization of the office. The reorganizational plan now under consideration would make the Energy Office a comprehensive energy agency.

The Energy Office would be structured around a series of program priorities such as industry, transportation and the consumer. The Energy Office is currently staffed with five professionals and two clerical positions. While the program has experienced a decrease in the number of positions during the last fiscal year, the program is expected to increase by a maximum of three positions and then stabilize. With the increase in staffing, the Energy Office anticipates expanding its activities to include increased technical assistance to industries in the evaluation and modification of their consumption patterns.

INDIANA STATE BOARD OF HEALTH

Environmental Program

Figure 1


State Health Commissioner
Environmental Management Board
Air Pollution Control Board
Assistant Commissioner for Environmental Health
Bureau of Engineering
Stream Pollution Control Board
Division of Sanitary Engineering
Area Personnel Section
General Sanitation Section
Housing, Schools & Hospitals Section
Solid Waste Management Section
Water Supply Section
Division of Air Pollution Control
Division of Water Pollution Control
Division of Industrial Hygiene and Radiological Health
Industrial Hygiene Section
Radiological Health Section

Pollution Control and Abatement Programs

I. AIR

A. Introduction

Air Pollution Control and Abatement activities within the State of Indiana are jointly administered by the following agencies: the Environmental Management Board (EMB), the Indiana Air Pollution Control Board (APCB) and the Indiana State Board of Health (ISBH).

The Environmental Management Board was created in 1971 by the Environmental Management Act. The responsibilities of the Board include: 1) protecting and enhancing the quality of the environment through evolving policies for comprehensive environmental development and control on a statewide basis and, 2) coordination and implementation of programs for the most beneficial use of Indiana's resources.

The Indiana Air Pollution Control Board was established in 1961 by the Indiana Air Pollution Control Law. This Board is vested with the responsibility for safeguarding the air resource through prevention, abatement and control of air pollution. The seven member board is empowered to conduct investigations, consider complaints, hold hearings, adopt and promulgate rules and regulations, issue control orders, and initiate appropriate action to enforce its orders. The Technical Secretary of the APCB and EMB is an Assistant Health Commissioner, and his office is the administrative link between the Indiana State Board of Health and the APCB.

The Indiana Air Pollution Control Division of the Indiana State Board of Health, established in 1962, provides the staff and funds for carrying out the directives of the APCB. The major objective of the Indiana Air Pollution Control Program is the protection of public health and welfare by achieving and maintaining the primary and secondary ambient air quality standards for particulates, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, and hydrocarbons. This is being accomplished through the promulgation and enforcement of air pollution control regulations which set limits on the amount of pollutants which may be emitted by the various sources throughout the state.

Some of the responsibilities for air pollution control have been delegated to local air pollution control agencies throughout the state. These agencies have jurisdiction over their respective areas. Local agencies are located in the cities of East Chicago, Evansville, Gary, Hammond, Indianapolis, Michigan City, and Anderson, and in the counties of Lake, St. Joseph, and Vigo.

For 1977, the following objectives have been defined as priority tasks for the Air Pollution Control Agency:

1) Conduct nonattainment and maintenance area analysis, strategy development, and plan preparation;
2) Concentrate enforcement effort on compliance with particulate and sulfur dioxide regulations in nonattainment areas;
3) Upgrade compliance tracking system;
4) Establish procedures for identifying new sources to prevent construction of any new sources without permits;
5) Monitor progress of written agreements with local agencies and encourage corrective actions through semi-annual evaluation of their Administration, Enforcement, and Engineering Programs;

6) Compile and calibrate long-term air quality models within nonattainment and air quality maintenance areas using available aerometric data for Set I pollutants;

7) Compile a completed air quality analysis for nonattainment and maintenance areas, for Set I and Set II pollutants;

8) Initiate a routine heavy metals analysis program;

9) Develop an auto emissions program.

B. Workforce Profile

In January 1976, the Air Pollution Control Division proposed a reorganization pattern with the formation of four branches: Standards and Planning, Enforcement, Air Monitoring, and Program Support. In addition to these four branches, there are administrative and legal support sections. The organizational chart in this section demonstrates the flow of responsibilities and the inter-relationship of the branches (Figure 1).

The Indiana Air Pollution Control Division is currently staffed with 101 positions: 86 professional and 15 clerical. The 86 professional positions represent engineers, scientists, attorneys, computer specialists, and electronics technicians. Over the past three years, the Air Pollution Control Division has experienced substantial growth in both the professional and nonprofessional positions. In 1973-74, the staff expanded from 25 to 60. In 1974-75, the staff grew to 75. The staffing level, as was mentioned previously, is currently 101. This rapid growth has been attributed to both the expansion of federal rules and regulations and the diversification of air pollution control activities. One major problem that emerged as a result of the growth has been a scarcity of qualified engineers and technical personnel. The current staffing level by profession is depicted in Table I below.

TABLE I

INDIANA STATE BOARD OF HEALTH

Air Pollution Control Division
Current (1976) Staffing Level

Position	1976
Engineer	27
Attorney	2
Meteorologist	2
Research Scientist	7
Sanitarian	35
Technician	4
Other	8
TOTAL	85

The Other category consists of one Information Specialist and one Programmer Analyst.

The Air Pollution Control Division recruits professionals through the Indiana State Board of Health Employment Office and colleges and universities offering environmental programs. Clerical positions are filled through the Personnel Office of the Indiana State Board of Health.

A total of ten local agencies are staffed and operating within Indiana. The territorial responsibility for each of the agencies typically covers the urban areas of the county in which it is located. In Lake County, jurisdiction is shared by one county and three metropolitan agencies. The local agencies, with jurisdiction over areas which include 37.6% of the state's population, have enforcement responsibility over 41.5% of the stationary source emission in the state.

The local air pollution control agencies are currently staffed by 55 professionals. Unlike the state agency which has experienced a steady increase in staffing, the local agencies have stabilized. During the last fiscal year only one local agency, the Indianapolis Air Pollution Control Division experienced a growth in staff. The staffing level grew from a total of 18 to 26 positions. Alternately, the Gary Air Pollution Control Division lost three of its 13 positions. This drop was attributed to the termination of a federal grant.

The average annual turnover rate for the local agencies is approximately 14% with the highest turnover occurring in the technician classification. The average turnover for the sanitarian is in the range of 25-30% annually. This high rate of turnover is attributed to poor working conditions and to the fact that they can obtain better paying jobs once they have been trained.

The local agencies employ a variety of methods to recruit personnel. Primary methods include advertising in state and local newspapers, professional journals, and by contacting and interviewing at colleges, universities and governmental environmental agencies. In a number of instances, the local agencies also advertise through the state employment service.

In an effort to assess the workforce situation, a variety of methods have been employed. The Director of the State Air Pollution Control Division and the directors of the Local Air Pollution Control Divisions were asked to estimate the number of persons involved in air pollution control and abatement activities within their jurisdiction. In addition, these estimates were supplemented with information provided through on-site interviews and with telephone conversations with selected private industries and utilities within the state.

While it should be recognized that information in this area represented "best professional estimates" of professionals practicing within the field, it is reasonable to predict that in excess of 1,300 persons are involved in varied air pollution and control activities within the state. There are generally three categories of professionals active in this field: engineers, attorneys, and technicians. The category of technician includes electricians, instrument repair persons, laboratory technicians and laborers. While most of the 762 major sources within the state employ a "part-time" engineer to supervise industrial air pollution control activities, it is projected that there are approximately 226 "full-time-equivalent" engineers employed within the field. It is further estimated that approximately 170 of the major sources retain "part-time" attorneys with an estimated 85 "full-time-equivalent" attorneys active in air pollution control fields. While figures on the exact number of technicians performing tasks considered to be related to air pollution control activities are more difficult to assess, it is predicted that as many as 1,017 technicians perform activities related to air pollution control.

The turnover rate for private industry is difficut to determine; however, experts within the field indicated that turnover within all levels of professions in private industry are minimal. This turnover rate is related to good salaries, employee benefits, and the fact that most persons within these positions are relatively high in the seniority system.

Private industry employs recruitment methods similar to those employed by the local air pollution control agencies, i.e., advertising in state and local newspapers, professional journals, and by contacting and interviewing persons employed at governmental agencies. Private industry does not consistently recruit through colleges and universities since they prefer professionals with experience in the field.

C. Workforce Projections

The Division is expected to level off at 125 positions by 1981. Any change in the number of positions within the department during the next five years will be a consequence of currently undefined enforcement duties or new air quality monitoring requirements. Further, it is anticipated that the adoption of the Clean Air Amendments could have a significant effect upon the staffing level of the department. Table II illustrates the anticipated growth by professional position within the division over the next five years.

TABLE II

INDIANA STATE BOARD OF HEALTH

Air Pollution Control Division
Workforce Projections to 1982 (est.)

Position	1976	1977	1978*	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	27	36	36	36	40	40	3%	9%
Attorney	2	2	2	4	4	6	0	30%
Scientist	9	10	10	10	12	12	20%	6%
Technician	4	4	4	4	4	4	75%	0
Sanitarian	35	49	49	49	49	49	3%	8%
Other	8	14	14	14	14	14	0	15%
TOTAL	85	115	115	117	123	125	8%	9%

*Staff increase is a biennial expansion. Therefore, figures for 1978 are rough estimates.

Turnover within the professional positions is singularly high. Positions within the Air Pollution Control Division are most attractive to recent college graduates. These graduates, once hired, generally remain at the agency for two to three years gaining valuable work experience. After a few years on staff, salaries and benefits offered through the State Board of Health are no longer competitive with those offered by private industry. Further, advancement within the department is slower than within the private sector.

While the staffing level of most of the local agencies has remained unchanged over the past year, the agencies are optimistic about the growth of their staffs. It is anticipated that the local agencies will stabilize at 66 professionals before 1982. This represents an overall growth rate of 20%. Most of the growth is projected for the sanitarian and engineering occupations. This growth is attributed to an expansion of regulatory and control activities as well as the increased need for technical assistance to municipalities in the development of local ordinances and to industries in meeting the EPA compliance standards.

Table III represents the project staff growth rates to 1982 for local air pollution control agencies. While the figures in Table III represent "best professional estimates", these judgements were made considering both the realistic expectations for funding of positions and the existing and expected demands for services. Any actual growth in this area must be correlated with the availability of federal, state and local funds to support air programs.

TABLE III

STATE OF INDIANA

Local Air Pollution Control Agencies
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	14	16	16	16	16	16		3%
Attorney	2	3	3	3	3	3		10%
Scientist	3	4	4	4	4	4		7%
Technician	10	13	13	13	13	13		6%
Sanitarian	26	30	30	30	30	30		3%
TOTAL	55	66	66	66	66	66	14%*	4%

*The 14% turnover rate was calculated for average total agency staff; specific information was not available on turnover rate by position.

In defining the estimated growth/decline of air pollution control positions within the private sector, the same method was employed in securing estimates for growth as was used in determining current status, i.e., interviews with directors of air pollution control agencies and personal and telephone interviews with environmental representatives in private industries and utilities. For purposes of this study, the industrial occupations related to air pollution control have been limited to three categories: engineers, attorneys, and technicians. Occupations within the engineering field are expected to grow 5% annually over the next five years; the number of attorneys active in the field are expected to grow by no more than 3%; and the number of technicians employed in air pollution activities is expected to increase by 7%. This growth reflects the expectation by private industry of increased and improved compliance activities.

Table IV represents rough estimates of the number of persons employed in the private sector in each of the three disciplines. These figures were arrived at through estimated annual growth rates. As with the local agencies, all staff expansion is dependent upon fund availability which is directly related to the fluctuations in the economy and upon federal legislation.

TABLE IV

STATE OF INDIANA

	Private Sector Workforce Projections to 1982 (est.)							
Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	226	237	249	261	274	298		5%
Attorney	85	88	91	94	97	100		3%
Technician	1017	1088	1164	1245	1332	1425		7%
TOTAL	1328	1413	1504	1600	1703	1823	Not Avail.	6%

D. Training and Certification

Indiana requires that field inspectors maintain visible emission certification. The certification programs are open to non-staff members involved in visible emission reading. The program has been operational for about four years. The Visible Emission Class is offered four times annually with each program lasting for eight hours. Approximately 50 persons enroll for each session with an average of 28 persons passing the examination. Those persons enrolling in the program are professionals and semi-professionals representing state personnel, the local air pollution control agencies, and private industry. It is estimated that the certification program will stabilize with approximately 500 persons participating annually.

Currently, the Bureau of Engineering, State Board of Health is in the process of developing a Car Emission Control Program. Last year, U.S. EPA awarded a grant to Colorado State University, Department of Industrial Science, to develop a training package for instructors in Motor Vehicle Emission Control Training. Two instructors from two Indiana high schools were sent to the training institute to become Training Trainers, i.e., instructors of other instructors. During this year, two training institutes will be held in Indiana to train an additional 40 instructors. The instructors will be selected from high schools, vocational technical colleges, area schools and other post-secondary institutions. It is expected that these instructors will return to their schools and develop training programs for 20-40 students per class.

The Air Pollution Control Division has developed a three-day orientation program for all new employees. The training provides the new entrant with basic information concerning the agency as well as exposure to EPA self-instructional programs. Specifically, all new employees are assigned to review EPA course SI:422, "Air Pollution Control Orientation" and SI:428, "Topics in Air Pollution Control". The Air Pollution Control Division devotes approximately 310 person-days to training per year. This number represents a composite of self-instructional training, seminars, and out-of-office training.

E. Career Potential

Career prospects within the air pollution control and abatement field appear bright. From the available information it appears that during the next five years there will be an average annual growth ranging from 6% in the state agency, 4% in local agencies, and 7% in the private sector. In most situations, positions will be available in both the professional and technical fields. While it appears as though the Clean Air Amendments would have a significant impact upon the staffing, experts within the field have indicated that undefined air quality monitoring requirements would possibly have a significant impact upon both the private and public sector.

Both the private and public sector have indicated that as much as 90% of the training of both professional and technical personnel occurs on the job. On-the-job training most generally consists of an informal sharing of work methods and techniques with more experienced personnel.

The training programs which are currently offered through both the universities and technical schools do not offer the necessary degree of technical information. Additionally, there appears to be a significant discrepancy between the training and on-the-job activities.

F. Conclusion

Three basic conclusions are apparent following a thorough review of the workforce projections for air pollution control and abatement activities in the State of Indiana:

1) that the career potential for all occupations within the air pollution area is continuing to develop and diversify;
2) that even though the manpower demands for personnel has somewhat stabilized as compared to the last five years, there will be a continual and growing demand for qualified personnel at all levels within the air pollution control field;
3) that technically oriented training programs for both professionals and technical personnel are at a premium.

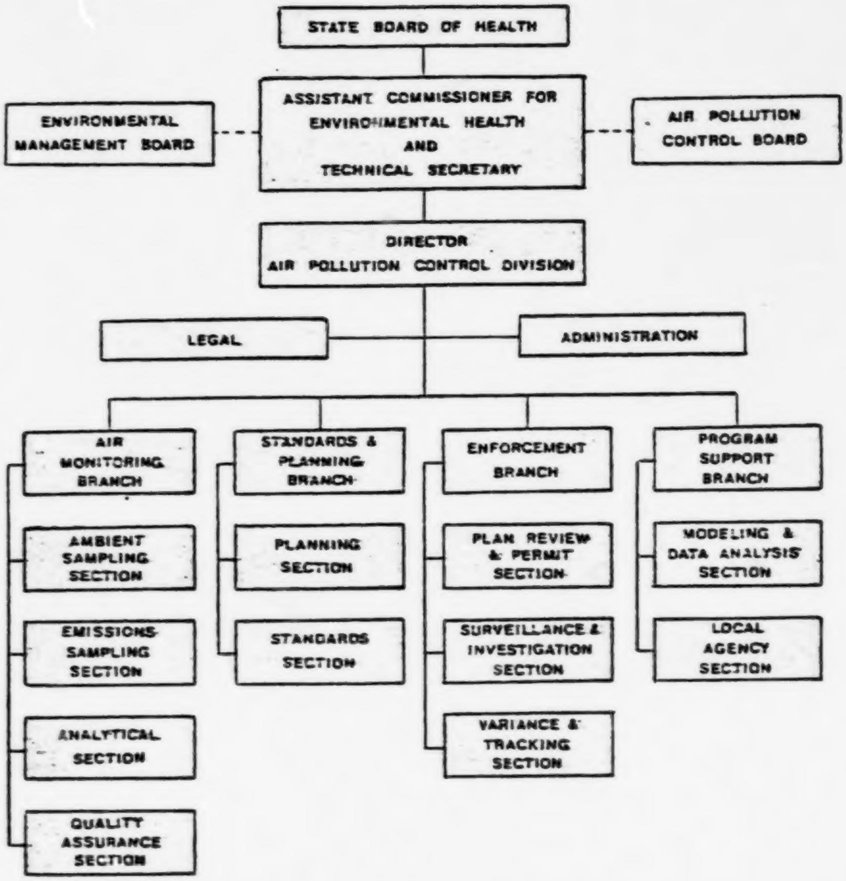
From these conclusions it is apparent that the colleges, the universities and technical schools might consider investigating the possible development of air pollution related courses/programs. Both private industry and the public sector expressed an interest in assisting educational institutions with the development of such programs. Private industries indicated that while they are currently involved with extensive on-the-job training, it is both expensive and time-consuming.

In addition, private industry believes that educational institutions are better qualified for the development and ongoing implementation of such programs. However, they implied that such training programs of necessity should include input from potential employers.

INDIANA AIR POLLUTION CONTROL DIVISION

Organizational Chart

Figure 2


STATE BOARD OF HEALTH
ENVIRONMENTAL MANAGEMENT BOARD
ASSISTANT COMMISSIONER FOR ENVIRONMENTAL HEALTH AND TECHNICAL SECRETARY
AIR POLLUTION CONTROL BOARD
DIRECTOR AIR POLLUTION CONTROL DIVISION
LEGAL
ADMINISTRATION
AIR MONITORING BRANCH
AMBIENT SAMPLING SECTION
EMISSIONS SAMPLING SECTION
ANALYTICAL SECTION
QUALITY ASSURANCE SECTION
STANDARDS & PLANNING BRANCH
PLANNING SECTION
STANDARDS SECTION
ENFORCEMENT BRANCH
PLAN REVIEW & PERMIT SECTION
SURVEILLANCE & INVESTIGATION SECTION
VARIANCE & TRACKING SECTION
PROGRAM SUPPORT BRANCH
MODELING & DATA ANALYSIS SECTION
LOCAL AGENCY SECTION

II. NOISE

A. Introduction

Industrial/Environmental noise control and abatement activities within the State of Indiana are emerging. In recent years, there has been an increasing interest in industrial hygiene. This interest was a direct result of the Federal Occupational Safety and Health Act of 1970. While compliance activities for OSHA have only peripheral relationship to industrial/environmental noise, they have had an impact on the awareness of the public to such noise.

The Environmental Management Board, which was created in 1971, was delegated responsibility for adopting standards and regulations prescribing limitations on noise emissions:

> In establishing such regulations and standards, the board may prescribe that no person shall emit or cause to be emitted any noise which unreasonably interferes with any lawful business or activity or is injurious to the health or well-being of any person. The board may adopt regulations and standards as to equipment and procedures for monitoring noise and the collection and retention of data resulting from such monitoring and the reporting of the same to the board.

While the board has the authority to develop an industrial/environmental noise program within the state, until recently, efforts to control noise had been directed at in-plant noise, e.g., OSHA requirements. However, during the last year, public awareness of the need for environmental noise control programs has surged. In recent years, most community noise complaints have been concerned with transportation related noise, i.e., vehicular and airplane. During 1976, however, approximately sixty complaints were filed with the Indiana State Board of Health with regard to industrial noise. This represents a one hundred percent increase in the number of complaints filed the previous year.

Both in-plant noise programs and industrial/environmental noise programs are administered through the Indiana State Board of Health, the Division of Industrial Hygiene and Radiological Health. The Indiana Department of Transportation does have legislative control over muffler and motor vehicular noise; however, there is no comprehensive enforcement activity.

B. Workforce Profile

The Indiana State Board of Health currently employs two persons whose responsibilities include follow-up on community/environmental noise complaints. These two persons have a background in industrial hygiene and have been providing technical assistance to municipalities in the development of noise ordinances. In addition, they have been encouraging both cities and individual citizens to become involved in development of local noise programs. Since funding is limited, most of these activities are related to the complaint system, e.g., when an individual or group files a complaint they are given information and assistance, when requested, on development of local noise ordinances and programs. It is estimated that less than one-half person-year is devoted to community and environmental noise activities.

As with the state, municipalities and private industries have relatively underdeveloped industrial/environmental noise control and abatement programs. There are currently six cities in Indiana with some type of noise ordinance. The following table depicts the type of ordinance each city has.

TABLE V

STATE OF INDIANA

Municipal Noise Ordinances (1975)

City	Nuisance	Zoning	Vehicle	Aircraft	Building	Construction	Recreational Vehicle
Evansville	0	X	X	X		0	X
Gary	0	X	0				
Hammond	0	X	X	X			X
Indianapolis	X				0		
Ogden Dunes		X					
South Bend	0		0			0	

KEY: X - Regulations including acoustical criteria
0 - Regulations not including acoustical criteria

(Chart excerpted from Sound and Vibration, December, 1975. Clifford R. Bragdon, Contributing Editor.)

Contacts with these cities indicated that the programs are operated in most instances through the police department. Generally one police officer has been delegated responsibility for supervision of noise enforcement activities. In the City of Evansville, the responsibility for noise activities is jointly shared by the Department of Health, Environmental Division and the Evansville Police Department. The Environmental Division employs one program manager with dual responsibilities for land, water and noise. In most instances, there is no actual enforcement of vehicular noise by the police department; instead, an attempt is made to control vehicular noise through annual vehicle inspection (state law).

Further, it has been estimated that most of the major industries in the state employ safety officers who are indirectly involved with plant noise activities. Again, it should be stressed that these individuals are charged with the responsibility of ensuring that the in-plant environment is in compliance with OSHA standards. However, it is reasonable to assume that a secondary responsibility of the safety officer would be the monitoring of external industrial noise. There are estimated to be more than 800 such safety officers in the state.

In March, 1973, the Department of Metropolitan Development, Division of Planning and Zoning, Indianapolis, released a working paper on noise for the city. The report provided a rather comprehensive view of the problem of noise pollution and contained recommendations for steps to be taken by the City/County Council and the Metropolitan Development Commission to alleviate impending problems. No action has yet been taken by the city on the recommendations of the commission; however, the Holcomb Research Institute which is associated with Butler University has developed a grant proposal for submission to U.S. EPA to finance further study of Indianapolis noise problems. Holcomb has devoted one person-year effort to this grant; however, to date no interest has been demonstrated in it.

C. Workforce Projections

During the next five years it is expected that there will be an expanded interest in community/environmental noise. It is further anticipated that some type of licensing or inspection procedure will be developed. In response to these projections, the Division has requested two additional positions for the coming fiscal year. It is hoped that these two positions will be filled by engineers with some experience in noise and acoustics. These persons will be charged with the responsibility for the development of community/environmental noise programs. Most of their activities will be directed at monitoring of noise levels upon request. However, they will continue the ongoing technical assistance program to cities and individuals in the development of municipal noise ordinances and programs.

As the program develops, it is anticipated that additional positions will be needed to operate and administer the program; the exact number of positions would be difficult to predict. As new positions are funded, persons with backgrounds in noise/acoustical engineering will be recruited. Since this type of background is rare, individuals with backgrounds in industrial hygiene and experience in noise may be sought, if necessary.

Recruiting for these positions will be accomplished through contacts with local universities, "word of mouth", and through advertising in professional journals. Recruitment for this program presents a major problem since there is a scarcity of acoustical/noise engineers. The department anticipates that the individuals hired for the positions will require extensive on-the-job training.

Workforce projections for the private sector are nebulous. Any increase in the private sector workforce allocations will be solely dependent upon the expansion of state and municipal enforcement activities. While the State Department of Health has projected an expansion of its program, the type of program proposed by the department will have an inappreciable impact upon staffing in the private sector. Therefore, unless new legislation is developed which influences the monitoring and enforcement activities of the state and subsequently, private industry, the private sector workforce staffing levels in noise pollution abatement and control are predicted to remain reasonably constant with no more than a 3-5% annual growth. This minimal growth rate is attributed to the increased demand by industry for technical noise consultants.

D. Training and Certification

Due to the complexity of noise activities within the field, training for professionals within the field is accomplished at four-year and graduate institutions. Specifically, individuals with degrees and experience in acoustical engineering are at a premium. In addition, there is a demand for individuals with degrees and experience in engineering, physics and related programs.

The technical schools have yet to develop programs related to noise pollution since the demands for such personnel are currently rather minimal.

E. Career Potential

The career potential in the community/environmental noise field is currently rather weak; however, during the next five years,the situation is expected to improve. The public sector is anticipating the expansion of workforce to include a number of full-time acoustical engineers. Additionally, while growth of noise-related personnel within private industry is not expected, there will most certainly be an increased demand for technical consultants.

The expected growth is,therefore,centered around professionals with qualifications in sound and acoustics and specifically for individuals with acoustical engineering experience.

While there is no apparent emerging demand for "technical" personnel in the noise field, any major expansion of noise pollution enforcement would necessarily have a great impact upon the number of persons with technical training in noise monitoring.

F. Conclusion

Noise control and abatement programs within Indiana are presently relatively underdeveloped. However, during the next five years programs are expected to emerge with emphasis upon selective monitoring and provision of technical assistance to industries in upgrading their noise monitoring and control activities and to local groups in development of local noise programs. As such programs are developed and improved, there will be an increased demand for professionals with experience in noise. While there is no apparent demand for technicians in the noise field in the immediate future, it is believed that during the next ten years there will be a growing demand for such lower level professions.

III. PESTICIDES

A. Introduction

The Indiana Office of the State Chemist and Seed Commissioner (State Chemist's Office), located at Purdue University in West Lafayette, Indiana, is the principal pesticide regulation and control unit within the state. Until recently, the State Chemist's Office has been principally concerned with product registration and product quality. However, with the official submission of the Indiana State Training and Certification Plan for Pesticide Applicators late in 1975, the State Chemist's Office became the lead agency for the coordination of certification of pesticide applicators. There are several other state agencies which are cooperating in this effort. They include: the Indiana Pesticide Review Board, the Indiana Cooperative Extension Service, and Purdue University.

The coordination activities between the State Chemist's Office and the cooperating agencies have been effective for some time in the development and support of enabling state legislation. The State Chemist's Office is the established state body for coordinating, reviewing and recommending necessary regulations and policies for state requirements. This office develops and recommends legislation, as in the case of the 1975 Indiana Pesticide Use and Application Law, and has the power to establish regulations pertaining to state policy through the regular state hearing process.

The State Chemist's Office meets regularly with the Pesticide Review Board and serves as a technical advisor as well as administrator of regulations and policies. The supporting training programs are given policy guidance by the Cooperative Extension Service Pesticide Advisory Committee which includes a representative of the lead agency.

The primary responsibilities for the training and certification of pesticide applicators will be accomplished by the Cooperative Extension Services through the State Chemist's Office. Nevertheless, a close liaison will be maintained with the various state agencies having related functions through the Indiana Pesticide Review Board. In the development and ongoing operation of the program, Purdue University will provide staff specialists and consultants.

The Indiana pesticide and pesticide container disposal program will be operated through the Solid Waste Division, Indiana State Board of Health and coordinated with the policies and recommendations of the Indiana Pesticide Review Board and the Office of the State Chemist.

In summary the State Chemist's Office will provide those state policies necessary to augment the existing legislation. The State Chemist will provide the administration of Board regulations and policies and will provide additional operational guidelines and procedures necessary in the execution of the certification program. The Cooperative Extension Service Pesticide Advisory Committee will provide the guidelines and support to the Pesticide Training Coordinator. The State Chemist's Office, as lead agency for the Governor, is responsible for accomplishing the total certification program for pesticide applicators. The Pesticide Review Board will provide overview functions of the programs and policies established by the State Chemist's Office.

B. Workforce Profile

The Office of the State Chemist, which is responsible for the regulation and control of pesticides as well as being the lead agency for pesticide applicator certification, is currently staffed by 15 professionals; 13 chemists and 2 entomologists. Of the 15 staff members, five are directly involved with the applicator certification program: Dr. E. D. Schall, Indiana State Chemist; George L. Hutton, Pesticide Administrator; Dr. Richard H. Collier, Assistant Pesticide Administrator for Registration and Supervisor of Pesticide Laboratories; Dr. C. Edward McCoy, Jr., Manager of Private and Commercial Applicator Certification Program, L. O. Nelson, III, Manager of Commercial Applicator Certification Program. Under the Pesticide Certification Program, five additional positions are to be filled, one manager of Dealer Registration Program and four Pesticide Investigator-Inspectors. These positions will likely be filled by scientists with a background in chemistry, entomology or related science.

The Indiana Cooperative Extension Service, which has been delegated the training responsibility for the applicator certification program, has allocated six person-years effort within the state office and four person-years within the county offices to the program. The four person-years within the county offices represent the consolidated efforts of the county agents in organizing and teaching of local training programs. On the state level, three person-years are allocated to the private applicator certification program and three to the commercial applicator program. The three persons in the private program are two entomologists and one botanist. The three person-years in the commercial program represent contributions by assistant and associate professors with expertise in botany, plant pathology, entomology, horticulture, agronomy, forestry and conservation, agricultural economics, animal science and veterinary science.

The Indiana State Board of Health is primarily involved in pesticide pollution control through its Solid Waste Management Division of Water Pollution Control and the section of the Division of Sanitary Engineering. The former monitors for pesticides in water while the latter is involved in developing approvable sites for disposal or pesticides and pesticides containers.

According to the Indiana Pesticide Use and Application Law of 1975, there are two classifications of private sector pesticide applicators: private and commercial. While available information on private sector workforce statistics is sketchy, it is projected that 35,000 of the 105,000 farmers within the state will seek certification as private pesticide applicators. It is further estimated that there are 7,000 to 8,000 licensed operators, licensed applicators, licensed public applicators and other certified commercial applicators who will require commercial certification. In addition, a current estimate indicates that there are a total of 800 to 1,000 dealer or dealer organizations within the state. While data are inconclusive, there are indications that a number of university botanists, plant pathologists, entomologists, conservationists, agronomists, sanitarians, chemists and engineers within the state have a major role in both pesticide research and consultant activities; however, no specific figures are available.

C. Workforce Projections

Within the state agencies, staffing levels for pesticide programs are estimated to remain stable; however, program staffing is contingent upon the demands of the Pesticide Applicator Certification Program. Until the program has been in operation for a full year, it will be difficult to make any concrete estimates. For the positions within the state agencies turnover was nil. Most persons who are recruited for these positions are required to have a minimum of a B.S. degree in chemistry, life science, botany or entomology. It is generally required that these persons also possess experience within the field. Methods used for recruiting candidates include advertising in national journals and at universities and colleges.

In light of the nebulous nature of the pesticide control situation within the State of Indiana, any effort to develop specific workforce projections for the private sector would be based solely on conjecture. Nevertheless, given that the current workforce estimates are reasonably accurate, the situation for all segments of the private sector are expected to remain relatively unchanged. No information is available on annual turnover rate for these workers, however, it is expected to be minimal. Further, experts within the field indicated that there is no emerging legislation or technology which will have a bearing upon workforce projections.

D. Training and Certification

The principle thrust of pesticide training within the state is focused upon pesticide applicator training. The Indiana Cooperative

Extension Service has been delegated the responsibility for coordination of this training. For the private applicator certification training program, the ten extension areas are the prime focus of activity. They are used to facilitate both the accounting and contacting of private applicators and the training session schedules. Within the area system, Indiana has special crop production agents; it is this group of agents who are utilized in actual training. All agricultural extension agents are utilized to schedule training sessions, communicate with private applicators, and assist with the training. Estimates indicate that 35,000 farmers will be trained.

The area extension regions are not, in general, used for the commercial categories since they are to be accounted for by occupations with training sessions scheduled where most propitious. Instead, Indiana is utilizing a system of category leaders whose responsibility is to coordinate the training for their particular category. There are ten categories as defined by state legislation which include: Agricultural Pest Control, Forest Pest Control, Ornamental and Turf Pest Control, Seed Treatment, Aquatic Pest Control, Right-of-Way Pest Control, Industrial, Institutional, Structural and Health-Related Pest Control, Public Health Pest Control, Regulatory Pest Control and Demonstration and Research. The following table represents the estimated number of commercial applicators and operators expected to be certified in 1976-1977.

TABLE VI

STATE OF INDIANA

Commercial Applicators and Operators To Be Certified By 1977 (est.)

Category/Sub-category	Number of Operators	Number of Applicators
Agricultural Pest Control		
- Plant	700	1,800
- Aerial	50	100
- Animal	100	100
Forest Pest Control	20	40
Ornamental and Turf Pest Control		
- Ornamental	385	1,135
- Turf	350	350
Seed Treatment	150	150
Aquatic Pest Control	75	50
Right-of-Way Pest Control		
- Ground	90	225
- Aerial	50	100
Industrial, Institutional Structural, and Health Related Pest Control		
- Industrial, Institutional, and Health Related	300	700
- Wood Destroying Pest Control	100	100
- Food Manufacturing, Processing and Storage	100	100
- Public Service Operator		800
Public Health Pest Control		100
Regulatory Pest Control		20
Demonstration and Research Pest Control	110	500
TOTAL	2,580	6,370

Additionally, the Indiana Cooperative Extension Service will be the primary avenue for ensuring that applicators are kept up to date with changing technology and continue a suitable level of competency. By means of ongoing county-by-county training programs, private applicators will constantly receive additional information through communication media including direct mail, scheduled meetings with specialists, and closed circuit television. With regard to the commercial applicators, the Cooperative Extension Service expects to build upon the framework now existing in seminars, short courses, and conferences. There are several organizations and conferences in Indiana that are currently meeting on an annual basis. It is anticipated that these organizations and conferences will be a medium for distributing information.

The Indiana Pesticide Applicator Certification State Plan specifies the intention to use Continuing Education Units (CEU) as an indication that commercial and private applicators are upgrading themselves with new technology. The continuing education unit guidelines have been discussed but nothing formal has been developed; however, early predictions indicate that commercial applicators will be required to obtain approximately twice the number of CEU's for three-year recertification as the private applicator, e.g., six versus three or eight versus four.

Another segment of the pesticide training will include an orientation for pesticide dealers. Dealers electing to sell restricted-use pesticides will be required to register with the State Chemist. As a result, dealer orientation sessions will be held throughout the state. At these sessions, dealers will receive copies of the current restricted-use list, be given instructions on identifying licenses, permits, and certificates, and trained in record-keeping for the restricted-use pesticides sold.

Indiana Cooperative Extension Services views the present training program for pesticide applicators as a necessary acceleration of its normal function of preparing applicators in the proper use of pesticides. Following the initial survey of activity during the next year and a half, the training program will be reduced to accommodate the needs of applicators, to keep pace with changing technology and maintain a suitable level of competence. Also, as part of the continuing program, training workshops will be scheduled for new persons and others seeking certification for the first time.

E. Career Potential

While the demand for professionals and para-professionals in the pesticide pollution control programs will remain relatively stable in both the private and public sector, there will be a diversification within the skills and knowledge bases required by those professionals in the field.

F. Conclusion

From the survey of activities in the pesticide pollution control field within the State of Indiana, three conclusions can be drawn:

1) that the concrete information on either the current or projected workforce needs is not currently available. Nevertheless, following a full year of operation of the Pesticide Applicator Certification Program, information of this nature will be more readily available;

2) that there is no apparent emerging legislation or technology which will have a significant impact on either the state or in-state workforce profile;

3) that the workforce situation is expected to remain reasonably stable to 1982.

Further, no specific conclusions can be drawn regarding emerging occupations or diversifications within the field until an accurate picture can be obtained concerning the current pesticide control field within the state.

IV. POTABLE WATER

A. Introduction

In the State of Indiana there are 455 public water supplies which serve a total of 740 communities. Approximately 66% of the total population of the state is served by these water supplies, i.e., 3,411,837 persons. An estimated 184 communities are served by the 57 surface water sources and approximately 556 communities are served by the 396 ground water sources.

The following list illustrates a breakdown of surface and ground water sources by type of treatment and number of communities served (1975 Public Water Supply Annual Report).

SOURCE/TREATMENT		NUMBER OF SUPPLIES	NUMBER OF COMMUNITIES SERVED
Surface Water Sources:			
Complete Treatment		51	174
Complete Treatment and Softening		6	10
	Subtotal	57	184
Ground Water Sources:			
Iron Removal, Softening and Chlorination		48	59
Iron Removal and Chlorination		117	155
Softening and Chlorination		11	29
Chlorination Only		206	299
Untreated		14	14
	Subtotal	396	556
	TOTAL	453	740

The Indiana State Board of Health is the state lead agency for potable water surveillance. The Public Water Supply Section of the Division of Sanitary Engineering is the primary administrative unit for the program. The Public Water Supply Section receives technical support from the Water and Sewage Laboratory. The In-State Public Water Supply programs are generally administered through municipal governments.

B. Workforce Profile

The Public Water Supply Section of the Division of Sanitary Engineering is the principal potable water classification and surveillance section within the Indiana State Board of Health. The ultimate goal and responsibility of the section is to ensure that all public water supplies are continuously operated and maintained so that the water is safe in quality, clean and adequate in quantity, and of mineral characteristics satisfactory for ordinary domestic consumption. Specifically, the Public Water Supply Section has been delegated five monitoring and regulatory functions. These functions include:

1) certifying all water treatment plant and water distribution system operators;
2) operating and monitoring the Indiana NPDES program for public water supplies;
3) visiting all water works supplies and collecing samples for chemical analysis;
4) maintaining and updating information on public water supplies;
5) reviewing and approving all construction plans for public water supplies.

These responsibilities have a statutory basis in the Environmental Management Act of 1971.

The 1977 operational priorities for the Public Water Supply Section include:

1) to ensure that all plants will be operated by certified operators;

2) to guarantee that all public water supplies are identified, certified and report to the Indiana State Board of Health.

Supportive laboratory services are provided to the Water Supply Section by the Water and Sewage Laboratory. The Water and Sewage Laboratory, a program of the Bureau of Laboratories has two specific functions:

1) to provide laboratory services to the Sanitary Engineering Division for testing of public and waste water samples;

2) to survey and certify local laboratories for bacteriological testing.

Most of the examinations performed by the Water Sewage Laboratory for the Sanitary Engineering Division are on drinking waters for potability, and swimming pools and bathing beach water samples for quality. However, a substantial number of other samples are examined: sewage samples for the general sanitation section and solid waste samples for the Solid Waste Section. During the last year, the laboratory performed 43,985 bacteriological and 23,304 chemical examinations on water samples.

The Indiana Public Water Supply Section is currently staffed by 11 professionals and three clerical persons. While the professional positions currently consist of sanitary engineers and water works supervisors, plans call for the addition of sanitarians in 1977. The following table depicts the current staffing level by position for the section.

TABLE VII

INDIANA STATE BOARD OF HEALTH

Public Water Supply Section
Current (1976) Staffing Level

Position	1976
Engineer	9
Water Works Supervisor	2
TOTAL	11

From 1975 to 1976, the Section experienced only a minor increase in staffing: one position was added to the staff. However, there was a slight shift in the occupational categories: in 1975 there were seven sanitary engineers, one sanitarian, and two water works supervisors.

Turnover for the Public Water Supply Section ranges from 15 to 18% annually within the professional positions. Turnover in the section is generally attributed to better job offers within the private sector. Professional position vacancies are advertised by the Indiana State Board of Health employment/personnel office through professional journals. There is no longer any recruitment activity with colleges and universities. Clerical positions are generally recruited through the State Employment Office.

The Water and Sewage Laboratory which allocates approximately 50% of its staff time to provision of supportive services to the Public

Water Supply Section is staffed with 23 persons (19 professionals and 4 clerical positions). The following table represents the professional staffing levels by position.

TABLE VIII

INDIANA STATE BOARD OF HEALTH

Water and Sewage Laboratory
Current (1976) Staffing Level

Position	1976
Chemist	13
Micro-biologist	5
Other	1
TOTAL	19

The "other" category consists of the program administrator. Three of the chemist positions were added during the last months of the year and are undergoing training. The activities of the remaining 16 professional positions were allocated in the following manner:

1) 12 persons for laboratory examinations of samples submitted to the laboratory;

2) 1½ persons for the training of outside personnel through workshops and consultation;

3) 1½ persons for quality control on laboratory work and laboratory self-improvement;

4) ½ person for surveying and certifying laboratories;

5) ½ person for administration.

The composite efforts of the staff of the Water and Sewage Laboratory provide approximately 8.5 person-years of technical laboratory services to the Public Water Supply Section annually.

Turnover within the Water and Sewage Laboratory averages 5% annually. Most turnover is attributed to better paying positions with more varied job opportunities. The laboratory recruits personnel through the Indiana State Board of Health employment/personnel office and at several engineering colleges and universities in Indiana.

The State of Indiana is currently conducting a survey of the public water supply workforce similar to the survey conducted for waste water treatment plant operators (see the Waste Water Section of this report for further information on the waste water survey). The results of the survey will be available within a relatively short time and will be included as an addition to this report.

C. Workforce Projections

The Public Water Supply Section is expected to grow by about 200% over the next five years. The greatest growth will be experienced in the number of engineers and sanitarians on staff. The following chart depicts this growth.

TABLE IX

INDIANA STATE BOARD OF HEALTH

Public Water Supply Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	9	13	16	24	24	24	18%	23%
Sanitarian	0	5	10	15	15	15	18%	27% *
Water Works Supervisor	2	5	5	5	5	7	18%	38%
TOTAL	11	23	31	44	44	46	18%	40%

*Calculation based upon 1977 as initial program year

The growth within this field is attributed to the increased enforcement activities. The environment/technical assistance program will be focusing upon providing direct services to the areas and municipalities in conforming with the Safe Drinking Water Act.

The Water and Sewage Laboratory is expected to grow approximately 10% annually in all professional positions. This growth will be a result of the corresponding growth in the Engineering Section. The following table represents the growth by profession through 1982.

TABLE X

INDIANA STATE BOARD OF HEALTH

Water and Sewage Laboratory
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Chemist	13	14	15	17	18	19	5%	10%
Micro-biologist	5	5	6	7	8	9	5%	10%
Other	1	1	1	1	1	1	5%	0
TOTAL	19	20	22	25	27	29	5%	9%

The expansion of the Public Water Supply Program and the Water and Sewage Laboratory will have little, if any, impact on the staffing of the public water systems. The State Board of Health indicated that any growth in this area would be a direct result of increased consumer demand as opposed to enforcement activities. No growth is expected. Turnover within the public water supply systems is extremely low, averaging no more than 1% - 5% annually. Most turnover in the higher level positions is accorded to retirement. Turnover in the lower echelon positions is related to better job opportunities. All positions within the public water systems are generally filled through the patronage system.

D. Training and Certification

The Indiana State Board of Health Regulation HSE 30-R, Classification of Water and Waste Water Treatment Plants and Water Distribution Systems, provides the classification system for Public Water Supplies within the state. The water distribution systems are classified on a population basis. There are two types: Class DS, a system serving less than 15,000 people, and Class DS-L, systems serving 15,000 people or more. There are six classifications of water treatment plants based upon population served and type of treatment. The classifications are CT, PF, GF-S, GF-M, GF-L and SP.

The Indiana Water Supply Annual Report for 1975 provides the following breakdown of distribution and treatment facilities by class:

Class	Number
Water Distribution Systems:	
DS	503
DS-L	35
Water Treatment Plants:	
CT	199
PF	169
GF-M	26
GF-S	11
GF-L	26
SP	0

A voluntary Water Treatment Plant Operators Training Program was initiated in the early 1950's. However, in 1974, certification became mandatory. The State Board of Health and Environment cooperates with the Indiana Section, American Water Works Association. Enrollment in the program has been steadily growing over the past two years. This growth is expected to continue through 1982. Approximately 200 operators are trained annually. This number is expected to grow to about 260 operators annually by 1981.

The State Board of Health cooperates with Indiana University Purdue University at Indianapolis (IUPUI) in offering this program.

The Public Water Supply Section is responsible for the certification of water treatment plant operators. The primary purpose of the certification program is to upgrade the quality of the operating personnel and to establish a link in the overall effort to provide a safe and adequate water supply. The principal goal of the certification program is to improve and strengthen the educational background of operating personnel with effective operator training programs that will assist in preparing the operator to take a comprehensive examination and to further his/her knowledge of operating procedures. The operator certification program was originated in July 1, 1972. The certification examinations are offered in various locations throughout the state in an effort to improve accessibility of the program to the local municipalities. The most recent figures available on the cumulative number of operators certified are the 1975 statistics. As of 1975, there were 776 Class DS and 112 Class DS-L Distribution Operators and 384 Class CT, 334 Class PF, and 88 Class GF-L Water Treatment Plant Operators certified.

The Public Water Supply Section cooperates with the American Water Works Association in offering a water works Operation Certification Seminar which trains approximately 250 persons annually. Of those persons trained approximately 99% are currently employed at Water Works Operations.

The Water and Sewage Laboratory is involved with training of water works personnel to a limited degree. Staff of the laboratory presented a lecture demonstration on bacteriological testing of drinking waters to a group of professional sanitarians. They were also involved in program presentations for the Indiana Section of the American Water Works Association. One was on the laboratory requirements of the Safe Drinking Water Act, and the second program was on the specific laboratory procedures required by the Primary Drinking Water Standards of the Safe Drinking Water Act. The laboratory is also involved with NPDES training in coordination with the Division of Water Pollution Control.

E. Career Potential

The career prospects for all levels of personnel involved in public water supply on the state level are extremely bright. However, the State Board of Health has experienced difficulty in the past in maintaining its personnel since job opportunities in the private sector are better.

Career prospects within the private sector appear to be quite limited. Turnover within professions is low and all upper level positions are generally filled through promotions. Most job opportunities within the private sector will continue to be in the lower echelon positions. The number of jobs available within the public water field will be stable through 1982 with any increase in programs resulting from increased consumer demand.

F. Conclusion

Three basic conclusions are evident following a thorough review of available information on the status of the public water workforce within the State of Indiana:

1) The Safe Drinking Water Act will exert a continuing impact upon the staffing of the state lead agency; however, there will be minimal impact upon the in-state workforce.

2) There are no new or emerging occupational types in the public water field.

3) The state and local municipalities have only experienced minimal difficulty in locating qualified applicants for existing positions.

With the advent of the Safe Drinking Water Act the existing NPDES permit program, and an increased awareness of cross connection hazards, water treatment plant operators with a high degree of technical knowledge and management skills are required. A limited number of educational programs are currently available. Experts within the state indicate that additional upgrade training programs will be necessary to acquaint operators with new programs and technological changes in their field.

ADDENDUM: Indiana Potable Water Program

The Indiana Public Water Supply Program has recently completed a workforce survey of public water supply systems. There are two types of systems: the distribution system and the water treatment system. There are two classifications of water distribution systems: DS and DS-L. The DS systems serve less than 15,000 persons, and the DS-L systems supply populations of 15,000 persons or more. The water treatment systems have been divided into six classifications: CT, PF, GF-S, GF-M, GF-L and SP. The classification systems, which is based upon the population served and the type of treatment, is as follows:

1) Class CT - Plants using chemical feed to achieve disinfection, fluoride standardization, or water stabilization, regardless of population served.

2) Class PF - Plants using chemical feed to achieve disinfection, or fluoride standardization, plus pressure or gravity filtration to treat well water sources for iron removal and/or ion exchange softening, regardless of population served.

3) Class GF-S - Plants requiring chemical feed, coagulation, flocculation, sedimentation, filtration and disinfection, or any combination of these processes, for the purification of water to serve fewer than 2,000 people.

4) Class GF-M - Plants requiring the same processes as a Class GF-S plant, but serving more than 15,000 people, or using a lime softening process regardless of the population served.

5) Class GF-L - Plants requiring the same processes as a Class GF-S plant, but serving more than 15,000 people, or using a lime softening process regardless of the population served.

6) Class SP - Plants employing specific and complex equipment not commonly in use for drinking water treatment in Indiana.

The recent survey of the public water supply facilities in the state revealed information concerning approximate crew size by classification. The 22 CT plants are staffed by one to two persons, generally one operator and one meter reader-repair person. In a one person operation, the functions of the position overlap.

The 169 PF plants are frequently staffed with 4 to 5 persons: 1-2 meter readers, 2 operators, and 1 maintenance person. As a rule the 11 GF-S plants are staffed with 3 to 4 persons which consists of a crew of 1 meter reader, 1 maintenance person, and 1-2 operators. The 26 GF-M plants have an average crew size of 4 to 5 persons which is composed of 2 operators, 1 maintenance, and 1-2 meter readers. The 26 GF-L plants have crews which average 12 persons. The crew generally consists of 1 supervisor, 1 secretary, 1 billing clerk, 3-4 meter readers, 4-5 operators, and the remainder maintenance personnel.

There are 503 DS distribution systems. The average crew size for this classification is 1 to 2 persons, usually 1 meter reader and 1 maintenance person-operator. The DS-L systems are generally staffed with 5 persons: 2 meter readers, 2 maintenance workers and 1 supervisor-operator. There are 35 DS-L systems in the state.

Turnover for all classifications of plants and systems is minimal. The turnover averages 0-5% annually.

If the predictions of the survey are accurate, there may be in excess of 2,500 persons actively employed in public water supply systems within the state. Experts within the field indicated that there will be growth in this area during the coming five years. They base their estimates upon predicted increases in the number of persons certified annually. It is anticipated that the number of persons seeking certification each year will average 125-135 annually. Of this number 50 of the persons will be new in the field, with 35 of the 50 being operators. The major source of growth within the field will be expansion and upgrading of existing facilities.

V. RADIATION

A. Introduction

In the past the principal focus of radiation control within the State of Indiana has been upon registration and monitoring of radiological health equipment and upon disaster and emergency planning. Environmental radiation, as an entity, has been relatively low priority and was considered only as an adjunct to emergency planning. However, with the prospect of the construction of two major nuclear power facilities within the state, environmental radiation control is becoming a major concern. Both nuclear power facilities, which will be discussed in greater detail in the energy section of this report, are scheduled for completion in 1982.

As nuclear power has emerged as a practical, alternative energy source, attention has been centered upon planning and implementation of measures to ensure that plant operation is consistent with a clean, uncontaminated environment. Chapter 9 of the Environmental Management Act of 1971 specifies the roles and responsibilities of the state with regard to atomic radiation monitoring and enforcement activities. Specifically, the law requires that any perons proposing to construct a nuclear-powered generating facility or a nuclear fuel reprocessing plant must file with the technical secretary (of the Environmental Management Board) an environmental feasibility report concurrent with the filing of the preliminary safety analysis required to be filed with the United States Nuclear Regulatory Commission. The Board may, in turn, conduct a public hearing on the environmental effects of the proposed plant. In addition, the Board may adopt regulations and standards to protect the citizens of Indiana from the hazards of radiation.

Indiana has a radiologic health X-ray program which is a combination of regulatory and voluntary activities for both Dental/Medical and Industrial programs. There are an estimated 2,757 dental and 2,084 medical X-ray programs and approximately 350 non-healing art X-ray programs in Indiana. In addition, there are approximately 289 facilities with Nuclear Regulatory Commission Licenses. (Statistics taken from a report prepared for the U.S. Department of Health, Education and Welfare, Report of State and Local Radiological Health Programs, October, 1976.)

The environmental radiation and radiological health programs are administered by the Radiological Health Section of the Division of Industrial Hygiene and Radiological Health. The primary program goal of the section has been to improve the control of harmful radiation effects to the citizens of Indiana. The Section stated that three of its principal achievements over the past year have been:

1) achieving substantial compliance with provisions of Regulation HRH-1, Control of Radiation, with various categories of healing arts practitioners;
2) the communications of the Indiana Area Radiation Emergency Response Committee have been centralized with distribution of a telephone notification number;
3) an emergency planning training component was completed as an integral part of the development of nuclear power facility Protective Action guidelines.

B. Workforce Profile

The Radiological Health Section is currently staffed by five full-time professionals, one part-time administrator, and one and one-fourth clerical persons. Since 1975, the section has experienced a sudden growth. The growth is a consequence of Indiana seeking "agreement state" status. In 1975, there were only two professionals and one clerical position. With one of the professionals leaving the staff after twenty years with the Indiana State Board of Health, four and one-half new staff members have been added to the department. The following table illustrates the distribution of staff by occupational type.

TABLE XI

INDIANA STATE BOARD OF HEALTH

Office of Radiological Health
Current (1976) Staffing Level

Position	1976
Health Physicist	2
Sanitarian	3
Administrator	1 (part-time)*
TOTAL	6

*The Administrator of the Radiological Health Section is shared with the Industrial Hygiene Section.

One major problem which has emerged as a result of the current and anticipated growth trends in the Radiological Health Section is that there is an apparent scarcity of qualified health physicists and technicians with background and experience in radiation surveillance and control. This problem complicates the recruitment procedures of the department. Most health physicists and radiological health technicians command salaries within the private sector which cannot be matched by the State Board of Health. Consequently, the section recruits persons with limited training in radiation control but with credentials in other environmental fields and provides them with supportive training in radiological health techniques. Most recruitment is handled through the Indiana Board of Health, Employment Office, with supplemental recruiting through colleges, universities, and professional journals. Clerical positions are filled through the personnel office of the Indiana State Board of Health.

Workforce statistics for the "radiation control" occupations within the private sector are nebulous. Currently, there is limited state involvement in this program. As a consequence, classification and surveillance of public sector radiation programs have been minimal. However, the Radiological Health Section was able to provide a general overview of activities within the state. Professional estimates indicate that universities, hospitals, and physicians/dentists account for a major sector of the private sector radiation programs.

While physicians and dentists utilize approximately 4,800 X-ray machines within the state, it has been estimated that staff time allocated by their offices to radiation surveillance is minimal. Monitoring and control of "radiation" at these sites is provided through periodic visits by the State Board of Public Health.

There are approximately 100 hospitals within the state which use radioactive materials. It is estimated that there is one full-time radiation specialist located at each of the centers with responsibility for supervision and organization of all aspects of radiation control and purchasing. For hospitals which use radioactive materials, disposal programs are usually limited to packaging the materials for return to the purchase source.

Universities are a major user of radioactive materials. The main universities within the state which have research activities that utilize radioactive materials are Purdue, Bloomington, and Calumet. The disposal program for the universities is not state operated, rather it is operated by a consortium. The materials are shipped by the universities to a site outside of the state, usually to South Carolina. Disposal of radioactive materials by universities accounts for approximately 10 to 20 tons per year. Personnel within the universities with strict radiation control activities would probably be limited to a maximum of one part-time person. Generally, the person responsible for radiation control would be a safety officer with other, diverse responsibilities.

There are an estimated 200 industries within the state that use some radioactive materials in production. The majority of the industries use radioactive materials for gauging activities. For example, a radioactive capsule may be planted in the wall of a furnace to indicate how fast the wall of the furnace is deteriorating. Most, if not all, of the radiation control activities for industry are handled by consultants or by the State Board of Health. There is no available estimate on the number of full-time consultants active in this area. It is expected that the number would be minimal.

C. Workforce Projections

Currently, the State of Indiana is not an NRC agreement state. However, over the next three years, the State Board of Health will be implementing programs and policies for compliance with agreement state eligibility requirements. Optimistic estimates indicate that agreement "status" will be achieved within three years. This process will have a major impact upon the staffing of the Radiological Health Section. For fiscal year 1977-79, eight additional staff positions have been requested; however, it is anticipated that a maximum of four of these positions will be granted. In either instance, all positions added will be health physicists. If all eight positions are obtained, four of the positions will be responsible for general environmental radiation and four will be responsible for radio-isotope licensing activities. The laboratory section will be responsibly for lab analysis of environmental samples. If activities of the department continue to expand, additional staff members may be required. However, the exact number cannot be determined at this point. All additional positions would be health physicists.

Increases within the private sector are expected to be minimal. Growth of use of radioactive materials are expected to be limited since radioactive materials are extremely expensive.

D. Training and Certification

The Radiological Health Section provides new job entrants with on-the-job training. As was mentioned previously, persons with qualifications in radiation or health physics are scarce. All new entrants currently attend a ten-week health physics course offered through Oak Ridge Associated University sponsored by the U.S. Nuclear Regulatory Commission. They also attend a one-week training program for emergency planning for fixed nuclear facilities and a week-long course on radiation inspection. New entrants are further provided with a minimum of one year in-service training at the State Board of Health. As the new entrants complete the first year of training, they continue to participate in continuing education programs offered through NRC. Each staff person receives an average of one month continuing education training annually.

Most persons recruited into the program optimistically should have backgrounds in radiological health, health physics or bionucleonics. While programs to train these professionals are limited, the existing programs are excellent.

E. Career Potential

While positions within the state department are expanding as a result of its seeking "agreement state" status, career potential for private sector radiation control programs will continue to be limited. The growing expense associated with the use of radioactive materials will limit growth if not decrease the amount of research and experimental treatment programs utilizing radiation. Since there is a limited number of persons currently involved in private sector radiation control, there will be an inappreciable impact on the radiation workforce level.

F. Conclusion

Radiation control, as an environmental concern, has been a relatively low priority of the Indiana State Board of Health. However, recently the state has developed plans to apply to the Nuclear Regulatory Commission to become an "agreement state". This process will have a direct impact upon the staffing of the Radiological Health Department: it will approximately quadruple the number of staff persons currently involved in environmental radiation control. There are two staff members presently active in this field.

Private sector use of radioactive materials is most generally limited to healing arts programs and research. However, private industry has used radioactive materials for gauging purposes in production. In all respects, private sector environmental radiation control programs and workforce demands are strictly limited.

VI. SOLID WASTE

A. Introduction

Prior to 1968, solid waste management activities were conducted by the Division of Sanitary Engineering of the Indiana State Board of Health. All state solid waste management activities were the responsibility of area personnel as one of their many duties. In 1968 three full-time solid waste management positions were established within the General Sanitation Section; however, all three positions were not filled and maintained until 1971.

In 1971, the Environmental Management Act designated the Stream Pollution Control Board as the state's solid waste agency. The Stream Pollution Control Board is a "policy" body for solid waste and the Solid Waste Management Section is the program administrative body. The Act prohibits open dumping/burning and provides that regulations may be adopted to support the provisions of the Act. The Act specifies the procedures for surveillance and enforcement, including civil and criminal penalties.

In July, 1973, the number of solid waste management positions was increased to 11, including clerical, and the Solid Waste Management Section was established in August, 1973.

The objectives of the department are four-fold:

1) To maintain and upgrade sound conventional solid waste management programs;
2) To develop a sound hazardous waste management program;
3) To develop a progressive resource recovery planning program;

4) To establish adequate administrative procedures for managing the overall solid waste management program.

In an effort to achieve these objectives, the solid waste management section has been divided into three functional components: Conventional Waste, Hazardous Waste Management, and Resource Recovery/Planning. The primary role of each of the three areas is to provide technical assistance, planning assistance, surveillance/enforcement activities, and operator training.

Solid waste management personnel have worked on multi-jurisdictional environmental problems with personnel from the air pollution, water pollution, and pesticide control programs of the State Board of Health. Since 1974 there has been extensive and ever-increasing interaction with the industrial waste management personnel. The staff of the Solid Waste Management Section are frequently consulted by personnel of the Division of Water, Department of Natural Resources, plus those of the U.S. Geological Survey, relative to the potential for groundwater contamination by proposed or existing landfill sites.

Prior to 1975, the regional planning agencies, for the most part, had no involvement with solid waste management planning. Nearly all of the eighteen regional agencies are either actively engaged in solid waste management planning or are considering initiating such planning within the next year.

B. Workforce Profile

The Solid Waste Management Section of the Indiana State Board of Health is currently staffed with twelve professionals. The majority of the professionals have backgrounds and experience in either engineering, public or environmental health. The following table illustrates the distribution of professionals by occupation types.

TABLE XII

INDIANA STATE BOARD OF HEALTH

Solid Waste Management Section
Current (1976) Staffing Level

Position	1976
Engineer	3
Sanitarian	8
Research Scientist	1
TOTAL	12

The largest subsection of the solid waste management program is the Conventional Waste Program with five and one-half professionals. The smallest subsection is the Planning and Resource Recovery Program staffed with one and one-half persons. The Hazardous Waste Program has five full-time persons.

Over the past year the Solid Waste Management Section has experienced only minimal growth: three professional positions have been added to the department, one sanitarian and two engineers/administrators. However, the growth rate is not reflected in the distribution of personnel among the three subsections. Previous to 1976, the Resource Recovery Planning Section was not staffed and the Hazardous Waste Program was staffed with a limited number of persons. During the past year, the conventional waste program was reduced from seven professionals to five.

The turnover rate within the section ranges from 25% annually for professional positions. This turnover is attributed to better salaries and more varied job opportunities within the private sector. New entrants are recruited through the Indiana State Board of Health employment office. In addition, qualified applicants are interviewed on a "walk-in" basis. Clerical positions are likewise filled through the personnel office of the Indiana State Board of Health.

For the purpose of examining the solid waste-related workforce profile within the state, the program was divided into four categories: sanitary landfills, hazardous wastes, collection systems, and resource recovery programs.

While sanitary landfills do not represent the only type of conventional waste program in Indiana, it is the most predominant conventional waste program. Nearly all open dumps are closed within the state, with approximately 40 sites remaining. Optimistic estimates indicate that these will be closed by the end of calendar year 1977. (These estimates do not include roadside dumps which are generally "unowned".) Another important form of convention waste sites would be the industrial dump site. Little information is currently available on industrial sites since Indiana is only just beginning to initiate an industrial site monitoring program.

There are currently 126 landfill sites within the state with approximately 70% of the sites municipally owned. However, an estimated 60% of the sites are privately operated. Over the past year, there has been an increase in the number of sites from 112 to 126. While there is only one classification of landfill, the sites are categorized according to tonage per day. The following illustrates the number of sites according to average tons per day.

Size of Sanitary Landfills

Average Tonage/Day	Number of Sites
0-50	58
50-100	22
100-200	19
200-500	14
500-1000	2
1000+	1

There are approximately 100 landfill supervisors located throughout the state with an estimated 400-500 landfill operators. An additional 100 positions which include such occupations as mechanics, weighmasters, equipment operators, spotters, gate attendants, and material handlers round out the remaining landfill site staffs. While the actual staffing patterns vary from site to site, the Solid Waste Section was able to approximate the size and composition of the staffing of solid waste sites for each category of site.

The 0-50, 50-100, and 100-200 tons/day sites are usually staffed with two full-time positions: one equipment operator and one gate attendant, and two half-time positions: supervisor and mechanic. The sites that handle 200-500 tons per day are generally staffed with six full-time positions: one gate attendant, one weighmaster, two operators, one supervisor, and one mechanic. The staffing pattern of the 500-1000 tons/day consists of one gate attendant, one weighmaster, four operators, one supervisor and one mechanic. The largest sites, the 1000+ tons/day sites, are staffed with two gate attendants, five operators, two supervisors, and five mechanics.

The number of landfill employees has grown approximately 5-10 percent over the past year; however, this increase can be attributed to the addition of 14 new landfill sites. Information available on the recruitment procedures and turnover rate for this category of conventional waste is limited. However, since many of the landfill sites are operated by municipalities, many of the positions are filled on a patronage basis. The turnover rate is estimated to be minimal with an average of five percent.

The Hazardous Waste Program is closely associated with the sanitary landfills. Any person or industry interested in disposing hazardous wastes must obtain individual item approval from the State Board of Health. The disposal site for the materials depends solely upon the category of materials. The State Board of Health, in coordination with the State Geographical Society and the Department of Natural Resources, makes a determination on which site is most appropriate for the disposal of the materials. The State Board of Health then issues a letter of permit to the person/industry indicating where the materials are to be dumped. The person/industry is responsible for transporting the materials to that site.

There are currently five sites within the state which can accommodate pesticides and hydroxide sludges. There are an additional five sites which can receive substances other than pesticides and hydroxide sludges. All of the sites are distributed throughout the state. Those sites which are designated as pesticide and hydroxide sludge receptacles generally do not hire additional persons for support of the hazardous waste programs. Therefore, the staffing level of the hazardous waste sites would be identical to that of the sanitary landfill.

The State of Indiana is currently conducting a survey of the municipal collection systems. Results of the survey are in the process of being compiled and will be included in an addendum to this report.

There are no existing resource recovery programs within the state. There are some voluntary recycling programs for paper, glass and metal. No information is available on how many exist, where they are located, or the number of persons involved in the activity. Too little information currently exists on the number of voluntary resource recovery programs to determine whether there are persons employed in these programs or if all services are donated.

During the next calendar year, a resource recovery plan will be developed for the state and one resource recovery program will be implemented by the Wabash Valley Regional Solid Waste District. During the next five years,an additional three facilities will be developed. The licensing program for the facilities will be the same as that for the sanitary landfills.

C. Workforce Projections

The Solid Waste Management Section will experience a steady growth over the next five years. The subsection experiencing the greatest growth rate will be the Hazardous Waste Program. By 1982, it is estimated that the Hazardous Waste Program may be staffed with up to nineteen professionals. The Conventional Waste Program will experience only minimal growth. Table XIII represents the anticipated growth by profession for the next five years. While fiscal constraints imposed by the governor and legislature may influence the rate of growth, the figures presented in this section are considered to be realistic both from a fiscal and service demand vantage point. This growth rate and distribution of staff among the three subsections is a reflection of the increased demand for services in hazardous waste and resource recovery, as well as an indication of a stabilization on the conventional waste program.

TABLE XIII

INDIANA STATE BOARD OF HEALTH

Solid Waste Management Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	5	9	14	16	20	24		39%
Sanitarian	6	10	14	16	19	23		32%
Research Scientist	1	1	2	3	3	3		30%
TOTAL	12	20	30	35	43	50	14%	35%

Equally as important as the overall staffing patterns is the allocation of staff persons to the three subsections. The distribution pattern provides a reliable indiator of the trends and modification in priorities over the next five years. The following tables describe the breakdown of occupations by subsection.

TABLE XIV

INDIANA STATE BOARD OF HEALTH

Solid Waste Management Section
Workforce Projections to 1982 (est.)

Conventional Waste Subsection

Position	1976	1977	1978	1979	1980	1981
Engineer	2	2.5	2.5	3	4	7
Sanitarian	3	5	6	7	8	9
Research Scientist	.5	0	0	0	0	0
TOTAL	5.5	7.5	8.5	10	12	16
Hazardous Waste Subsection						
Engineer	2	5	7.5	10	11	14
Sanitarian	2	4	6	7	8	12
Research Scientist	.5	1	2	2	2	2
TOTAL	4.5	10	15.5	19	21	28
Resource Recovery/Planning						
Engineer	1	1.5	4	4	4	4
Sanitarian	1	1	2	2	2	2
TOTAL	2	2.5	6	6	6	6

The Resource Conservation and Recovery Act of 1976 will have a minimal impact upon the staffing level of the section. While there may be a reorganization of staffing functions, no other positions will be added in addition to those previously projected.

Workforce projections for the private sector are difficult to make. Estimates as to projected growth in the private sector were basically gathered through interviews with Indiana State Board of Health representatives and select municipal 'public works' representatives. These representatives were not able to make estimates for each occupational type but rather made assessments for each solid waste category. The sanitary landfill workforce is expected to increase a minimum of 5% annually over the next five years for each occupational category. Since the hazardous waste program is operated through the sanitary landfills, the workforce projection would be identical to the sanitary landfill program. The collections system workforce is expected to experience a slight increase, approximately 5% annually.

The resource recovery program will become operational in approximately one to two years with the development of the Ouabache program. It is anticipated that the program will be staffed with a crew of fifteen members. The crew will probably consist of two supervisors, weighmasters, mechanics, and equipment operators. The equipment operators will require experience quite different from those employed at landfills since their tasks will vary significantly. With the organization of the three additional projected resource recovery programs, the workforce for these four programs will grow to approximately sixty persons. It is expected that no specific pre-service training and education will be required for these employees. Most, if not all of the training, will be provided on-the-job.

D. Training and Certification

The Sanitary Landfill Operator Training Program was developed in 1973. Between 1973-76, an average of twelve to seventeen workshops were offered annually. The programs are one day seminars offering a total of three hours of training. Between 1973-76 an average of 250-275 operators were trained annually. In 1976,there were about 300 persons trained. This level is expected to stabilize through 1981. Of those persons trained, 90% were currently working at sanitary landfills; the remaining 10% were new entrants into the field. Plans are being developed to offer a Sanitary Landfill Operator First Aid program in 1977. As with other operator training programs, the course will be offered in twelve to seventeen locations. The program will be offered in the evenings and will consist of two, four hour segments. It is anticipated that 250-275 persons will participate in the program. To date, no specific plans have been made to develop a landfill operator certification program.

The training program for the hazardous waste workforce is incorporated into the sanitary landfill operator training program. However, it is anticipated that by 1978 there may be a separate training program. The program would be offered once during the year and would probably consist of a single block of three hours of instruction at 12 to 17 locations. Certification of hazardous waste personnel will be entirely dependent upon federal regulations. Such a program has been conceptualized but nothing concrete has been planned or developed.

No training program or certification system exists for the collection system workforce. Nothing is planned in this area.

While no certification system is anticipated for resource recovery workers, a training program may be developed as the need arises. The development of such a program would be dependent upon the number of persons employed within the field and the types of facilities.

Employees of the Solid Waste Management Section participate in continuing education programs. During the most recent year, approximately thirteen persons participated in such training. An average of 195 training person-days is allocated to the department annually. Staff members also participate in inservice training programs as instructors. They are involved in approximately eight courses per year. In addition, they are involved in the sanitary landfill operators training program.

E. Career Potential

Career prospects within the solid waste field are positive. The average growth rate for the state program is 28% with all positions available in the professional categories. The greatest demand will be for engineers with experience in 'solid waste'. The private sector programs will grow approximately 5% annually. Career potential and upgrade opportunities for the sanitary landfill workforce are somewhat limited. However, with the on-the-job training which they receive, most solid waste program employees are able to obtain higher paying jobs in related occupations, i.e., the construction industry. While there are no distinctly unique emerging occupations in this area, the existing sanitary landfill positions may be altered to enable the landfills to accommodate other types of materials than are currently handled.

Career potential for individuals employed in collection systems are also considered to be limited; however, an enterprising individual can develop his/her own firm with a minimal capital investment. There are no apparent emerging occupations within the collection field.

As a developing field, the resource recovery program offers a bright career prospect for all occupational types. However, as with the sanitary landfill workforce, career potential may be limited within the field with career opportunities more readily available in related fields.

F. Conclusion

Two fundamental conclusions are manifest following a review of the workforce projections for the solid waste programs in the State of Indiana:

1) That there will be a continual growth in the demand for qualified personnel with experience in solid waste in both the public and private sectors;

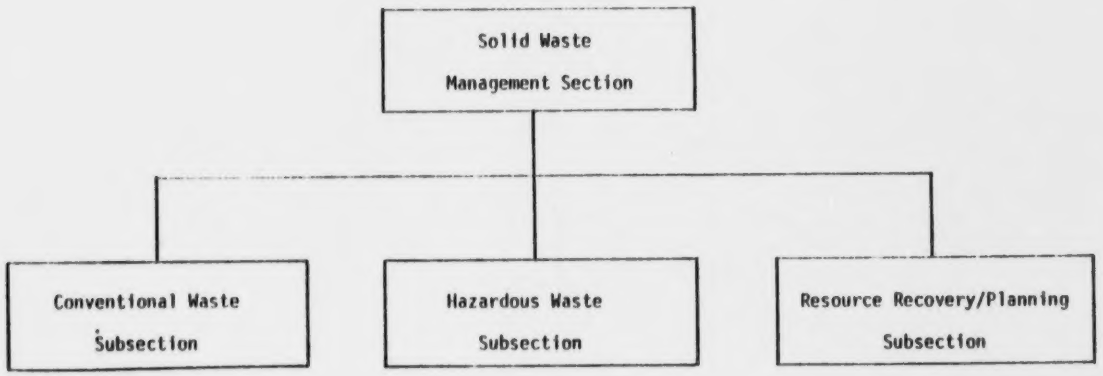
2) That career potential for all solid waste occupations is continuing to develop and diversify, but would still be considered somewhat limited for the lower technical skills.

Training programs for the technical occupations are generally offered through the State Board of Health. Educational institutions have not extensively explored solid waste training programs. With the growth in this field, educational institutions might well review technical training opportunities and possibly, coordinate the development of solid waste training programs with the Board of Health.

INDIANA STATE BOARD OF HEALTH

Solid Waste Management Section

Figure 3


Solid Waste Management Section
Conventional Waste Subsection
Hazardous Waste Subsection
Resource Recovery/Planning Subsection

VII. WASTE WATER

A. Introduction

The waste water treatment field is one of the fastest growing environmental fields in the State of Indiana. The Stream Pollution Control Board is the principal waste water regulatory agency in the state, with staffing provided by the Division of Water Pollution Control. The Division has experienced a rapid growth pattern during the past three years and it is anticipated that this pattern will continue for the next five years.

There are 312 municipal waste water treatment plants in the state and as many as 700 industrial treatment plants. The staffing levels of the facilities vary according to size and type of treatment. Dramatic growth is expected in all levels of personnel in both municipal and industrial treatment plants during the next five years.

B. Workforce Profile

The Water Pollution Control Division of the Indiana State Board of Health administers the Municipal Construction Grant Program, NPDES Permit Program, the Oil and Hazardous Material Spill Response Program and Area-Wide Section 208 Planning and Management. The program activities of the Division are supported by other sections and divisions within the Board of Health. The Water and Sewage Laboratory does all analyses of waste water samples. The General Sanitation Section of the Division of Sanitary Engineering reviews plans and specifications, administers the NPDES permit program issuance and compliance monitoring for semi-public facilities such as mobile home parts, subdivisions and waste water treatment facilities for public water supply systems. Systems and Data Processing provides basic equipment, key-punching programming to the program for data processing. Indirect support is provided in areas of budget, procurement, personnel and various divisions and sections within the Board of Health.

In January 1976, the Division of Water Pollution Control was reorganized into four branches and thirteen sections to form a functional organization more consistent with the program requirements. The four branches which were created include: Facilities Construction, Enforcement, Water Quality and Standards, and Program Support. The organizational chart included with this report illustrates the relationship of each section to the four branches. The reorganization was instituted to eliminate duplication of job tasks within many sections. It also created a new level of middle management, the branch chiefs.

In an effort to improve the efficiency of the department and to maximize program output, the division has implemented a management by objectives program. For each year of operation the division develops a series of priorities. The first level priorities are considered to be the primary operational objectives of the department for that year. The third level objectives would be considered desirable, however, minimal person hours will be devoted to those activities. For this fiscal year the first order priorities include:

1) Municipal Construction Grant Program

    a. expeditious award of grant funds
    b. prompt bid advertisement
    c. prompt selection of best low bid
    d. prompt arrangement for local financing
    e. prompt start of construction
    f. prompt grant payments
    g. prompt action on change orders

2) NPDES Permit Program

   a. early resolution of adjudicated permits
   b. prompt action on permit modification requests
   c. reissuance of permits
   d. issuance of permits to new dischargers
   e. compliance monitoring and enforcement for select major and significant dischargers

3) Oil and Hazardous Material Spill Response

   a. fish kill response and related enforcement
   b. pollution incident investigation and enforcement

4) Area-Wide Planning and Management - Section 208

   a. local agency designations
   b. coordination of local agency planning
   c. non-designated area planning

A principal goal of implementing a management by objectives program is that limited staff efforts can be organized to respond to the most important program objectives. Funding of the Water Pollution Program is critical for fiscal year 1977, since the federal government has not provided additional or sufficient funds to maintain the current staff and the state has not expanded its contribution except for inflation for existing staff (Program Plan, Fiscal Year 1977).

The Water and Sewage Laboratory commits approximately 8.5 person years of staff effort in support of the Water Pollution Control Program. (A description of the Water and Sewage Laboratory is contained in the Potable Water Section.) Last year the laboratory performed 2,557 bacteriological examinations and 46,648 chemical examinations on 3,775 samples for the Water Pollution Control Division. The total of the examinations were distributed as follows:

55% - water quality monitoring of rivers and streams
35% - special surveys to measure pollution in streams and outfalls of waste discharge
5% - industrial wastes
4% - agricultural wastes
1% - sewage

During the last three years the staff of the division has grown from 45 to 132 total positions. Other Divisions within the State Board of Health provided 23 person years of support; this brings the total effort of the department to 155 person years. With the addition of the part-time student intern program, the total resource effort is 158 person years annually. By comparison, there were 102 full-time employees in 1975, 85 in 1974, and 45 in 1973. This substantial growth pattern has been attributed to the impact of PL 92-500, Federal Water Pollution Control Act.

While the Water Pollution Control Division has been allocated 122 full-time positions, only 103 of those professional positions are currently filled. The current staffing level by profession is depicted in Table XV.

TABLE XV

INDIANA STATE BOARD OF HEALTH

Water Pollution Control Division
Current (1976) Staffing Level

Position		1976
Engineer		36
Sanitarian		51
Attorney		4
Planner		12
Other		10
	TOTAL	113

The "Other" category includes administrators, biologists, and sewage works supervisors.

The turnover rate for the Division was exceptionally high during the last fiscal year. The turnover rate was approximately 25%. This high percentage is attributed to the fact that salaries offered by the Indiana State Board of Health are not competitive with private industry. Once an individual gains adequate on-the-job training, more jobs are available in the private sector with increased pay and fringe benefits.

Position vacancies are advertised in national magazines. The Division also recruits at colleges and universities with environmental curricula. The Division will also interview qualified applicants on a 'walk-in' basis. Clerical positions are filled through the employment/ personnel office of the Indiana State Board of Health.

There are approximately 312 municipal waste water treatment plants in the state. Municipal waste water treatment plants are classified into four categories:

1) Class I - Plants having a design population equivalent of less than 2,000.
2) Class II - Plants having a design population equivalent between 2,000 and 10,000.
3) Class III- Plants having a design population equivalent between 10,000 and 40,000.
4) Class IV - Plants having a design population equivalent in excess of 40,000.

There are 110 Class I, 120 Class II, 54 Class III and 28 Class IV plants in the state. In the spring of 1975, the division conducted a workforce survey of Municipal Waste Water Treatment Plants. The survey provides an extensive breakdown of in-state staffing of municipal plants by plant classification. The following table depicts the current municipal plant staffing patterns.

TABLE XVI

STATE OF INDIANA

Municipal Waste Water Treatment Plants
Current (1976) Staffing Level

Position	Full-time	Part-time
Operator:		
Non-Certified	524	97
Class I	318	13
Class II	128	48
Class III	70	16
Class IV	12	26
Maintenance:		
Electrial (Non-Certified)	31	24
Mechanical(Non-Certified)	168	35
Class I	8	0
Class II	7	0
Class III	3	0
Other:		
Non-Certified	39	18
Class I	1	0
Class III	1	0
Laboratory:		
Non-Certified	53	26
Class I	14	4
Class II	12	5
Class III	11	1
Class IV	2	0
Laborer:	161	84

TABLE XVI(Continued)

Current (1976) Staffing Level

Position	Full-time	Part-time
Supervisory:		
Non-certified	95	25
Class I	10	0
Class II	15	4
Class III	41	3
Class IV	27	1
Sub-Totals:		
Non-Certified	1,071	309
Certified	680	121
TOTAL	1,751	430

(The information contained in this survey may be unique to the State of Indiana and, as such, may not be available in other states.) The survey also collected information on position vacancies in the treatment plants for calendar years 1977 and 1978. The following table provides a summary of that information:

TABLE XVII

STATE OF INDIANA

Municipal Waste Water Treatment Plants
Projected Position Vacancies

Position	Number of Vacancies 1977	 1978
Superintendent:		
Class III	2	3
Class IV	1	0
Operator:		
Non-Certified	25	18
Class I	3	5
Class II	20	17
Class III	10	6
Class IV	2	2

TABLE XVII (Continued)

Projected Position Vacancies

Position	Number of Vacancies 1977	1978
Chemist:		
Non-Certified	1	0
Class II	2	1
Class III	3	0
Laboratory Technician	4	6
Industrial Inspector	4	0
Maintenance	5	5
Maintenance, Class II	4	0
Instrument Maintenance	6	0
Electrical Maintenance	2	1
Mechanical Maintenance	5	5
Utility Worker	6	6
Sampler	0	2
Laborer	5	3
TOTAL	110	80

There are approximately 700 industrial waste water treatment plants in the state. The classification system for the industrial treatment plants include four categories: Class A, B, C and D. For specifications on each class refer to the Legislation Section. No figures are available on the breakdown of the 700 industrial treatment plants by classification. However, general information is available on the estimated number of industrial waste water treatment plant operators by classification. There are approximately 1,467 industrial waste water treatment plant operators in the state: 462 Class A, 464 Class B, 282 Class C, and 259 Class D. These estimates were based upon the number and percentage of industrial treatment plant operators who are currently certified. To date the following number of operators have been certified by classification:

Class A	324
Class B	330
Class C	203
Class D	189

The workforce profile for the industrial operator would be similar to that of the municipal operator; however, there would probably be more part-time operators with other, more diverse responsibilities.

The Regional Planning Commission will be significantly involved with 208 Planning. There are currently six agencies becoming involved. The advent of 208 Planning has resulted in major increases in the staffing of the commission. Most of the agencies have up to nine positions on their staff whose sole responsibility is 208 Planning. Most of the positions are either planners or engineers; however, other positions include water sampling technicians, science educators, librarians, agricultural specialists, and public relations specialists.

C. Workforce Projections

Over the next five years it is estimated that the Water Pollution Control Division staffing level will collectively increase 41% in all professional positions with the greatest growth in the attorney category. This increase in staffing will be a direct result of increased demand for services and enforcement activities. The following table depicts the growth of the division by occupational title:

TABLE XVIII

INDIANA STATE BOARD OF HEALTH

Water Pollution Control Division
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	36	36	40	42	46	46	15%	5%
Sanitarian	51	51	55	56	58	61	15%	4%
Attorney	4	6	8	8	10	12	15%	26%
Planner	12	17	27	27	27	27	15%	20%
Other	10	10	12	12	12	12		4%
TOTAL	113	120	142	145	153	158	15%	7%

The only increase in the Other category is attributed to a dramatic growth in the number of water quality planners.

A continuing priority for the state program is to minimize the loss of the state's allotment of municipal construction grant funds by early award of grants to municipalities. To achieve this goal, the staffing of the construction grant program must be increased. Currently, the only available method is to divert staff from other programs. This method significantly impairs the operation of other programs which are, in many instances, insufficiently funded. While efforts will continue to upgrade the computer data processing program to track the status of grants and to identify bottlenecks, additional staffing will be required for this program for it to operate at optimal level.

The State 208 Planning Program began in January, 1976. At that time there were six regional planning commissions which had been selected for involvement in the program. It is possible that three additional planning commissions will become involved in the near future. Approximately one-third of the state is currently included in these designated 208 Planning areas. One of the criteria for determining a designated 208 Planning area is that a complex urban-industrial water quality problem exists within the boundaries of the designated area.

Consequently, two-thirds of the state (non-designated) consists of smaller urban areas and rural areas with a very different type of water quality problems. It is believed that the two most pressing and unresolved water quality problems for these areas are non-point source pollution from rural areas and inadequate sewage treatment in developing suburban areas. The Stream Pollution Control Board is the designated lead agency for 208 Planning and coordination and has special responsibility for the planning activities in the non-designated planning areas.

Currently, five senior planner positions have been added for the responsibility developing the state's effort for the non-designated 208 Planning program. It is anticipated that approximately 75% of the state's 208 work will be subcontracted with various state and federal agencies and private firms. The remaining 25% in-house commitment will be met with present staffing levels. Increased staffing will be needed for this program to ensure program success.

The staff has established and will distribute planning area delinations for the entire state. Pollution projections will continue to be coordinated and reviewed by the staff.

The one program which will have the greatest impact upon the staffing of the department will be enforcement activities associated with PL 92-500. Surveillance of municipalities and industries will require major staff efforts. As compliance deadlines are effected, staff efforts will shift from technical assistance activities to enforcement actions. The recent reorganization of the division will improve the tracking, enforcement and reporting programs. However, more staff members will be required to accomplish even minimal program goals.

The increased enforcement and program activities of the Water Pollution Control Division will have a substantial impact upon the staffing of waste water treatment and collection systems in the state.

While little information is available on specific increases by category of municipal and industrial treatment plants, preliminary projections by the State Board of Health indicate that staffing levels within the plants may increase as much as 300% during the next five years. If this estimate is accurate, the following table depicts the number of anticipated positions by classification in municipal waste water treatment plants by 1981.

TABLE XIX

STATE OF INDIANA

Municipal Waste Water Treatment Plants
Projected (1981) Staffing Level

Position	Number of Positions	
	Full-time	Part-time
Operator:		
Non-Certified	1,572	291
Class I	954	39
Class II	384	144
Class III	210	48
Class IV	36	78
Maintenance:		
Electrical (Non-Certified)	93	72
Mechanical (Non-Certified)	504	105
Class I	24	0
Class II	21	0
Class III	9	0

TABLE XIX (cont.)

Projected (1981) Staffing Level

Position	Full-time	Part-time
Other:		
Non-Certified	117	54
Class I	3	0
Class III	3	0
Laboratory:		
Non-Certified	159	78
Class I	42	12
Class II	36	15
Class III	33	3
Class IV	6	0
Laborer:	483	252
Supervisory:		
Non-Certified	285	75
Class I	30	0
Class II	45	12
Class III	123	9
Class IV	81	3
Sub-totals		
Non-Certified	3,213	927
Certified	2,040	363
TOTAL	5,253	1,290

Using the same 300% growth projection for Industrial Waste Water Treatment Plants, the estimated industrial treatment plant workforce for 1981 will be as follows:

Class A	1,386
Class B	1,392
Class C	846
Class D	777

The Indiana State Board of Health has limited information concerning both recruitment and turnover for municipal and industrial waste water employees. Consequently, select interviews were conducted with managers of all classifications of municipal plants and a random survey of industrial treatment plants was also carried out.

The industrial plants indicated that there was minimal turnover in all levels of positions and that the annual turnover averaged around 0-5%. Also, depending upon the skill requirements of the positions, they recruited from public programs, technical schools, colleges/universities, and professional journals.

The municipal plants reported that the turnover in positions ranged from 0 up to 50% in some positions. The highest turnover rate is in the lower skill positions. Opportunity for advancement in those positions is limited and, consequently, they tend to transfer into the private sector with better paying positions. Most recruitment for the municipal plants is through word-of-mouth and the patronage system.

This increase will have a concomitant impact upon the state training and certification programs. While programs exist to train waste water treatment plant operators, programs will be needed to train collection system personnel. A more in-depth analysis of the emerging training situation is included under Section D, Training and Certification.

The Regional Planning Commissions which were interviewed regarding their 208 Planning programs indicated that their staffing patterns would remain constant through 1980. However, as federal funds were phased out of the program, the directors believed their staffs would be significantly reduced. The total impact of the reduction of federal funds can not as yet by totally evaluated.

D. Training and Certification

In January, 1975, the Bureau of Engineering was successful in obtaining workforce planning capabilities through the IPA assignment of a Workforce Development Specialist from the EPA Region V office. One of the primary assignments of this position was to assess the training needs of municipal waste water treatment plants and to develop a proposed plan to meet the identified needs. In the spring of 1975, a survey was distributed to selected waste water treatment plants to collect information on the number and classification of employees, salary ranges, current/anticipated vacancies, participation in and evaluation of training programs, training needs for 1976 and 1977, training needs resulting from NPDES testing requirements, additional information to describe training needs, and suggestions for improvement of training programs.

The information collected relative to the workforce profile and projections has been correlated with other available information and discussed at length in the sections of this report dealing specifically with those issues.

The survey yielded interesting information concerning both current training programs and the identified priorities for future training. The following five items synopsize the findings contained in the conclusion of the survey report.

1) In most cases prior training courses were described as fair, good, or excellent. Therefore, it is reasonable to conclude that previous training programs have provided valuable assistance to the plant operators.

2) About 129 municipal waste water treatment plants have not participated in any training programs. Most of these plants are in Class I and Class II.

3) The estimated training needs of the municipal waste water treatment plant personnel for 1976 and 1977 include 646 operators, 190 laboratory staff, 136 maintenance workers and 59 professional staff. In addition, approximately 385 employees require instructions in the testing procedures demanded by NPDES permits. The instructional tasks consist of an estimated 98 separate courses or training sessions for the two-year period covered by the survey.

4) The respondents expressed a need for training to upgrade operator, laboratory, and maintenance skills. Interest was also evidenced for training in industrial waste monitoring and treatment procedures.

5) The respondents indicated a preference for short, practical, on-the-job instructions at or near the trainee's plant.

In summary, the survey indicated that there are significant numbers of on-line treatment plant staff members that desire training in addition to the training requirements for new entrants in the field.

Subsequent to this study, a proposed training program was designed to meet the apparent training needs. The program consists of six phases which are designed to reach the various occupations associated with municipal waste water treatment plants. The program consists of a Municipal Officials Management Seminar, Instructor Improvement Seminars, Operator Training - Entry Level, Operator Training - Skills Upgrading, Operator Training - Short Courses and Operator Training - NPDES.

The Municipal Officials Management Seminar was designed to acquaint the elected officials and appointed managers with their legal responsibilities under state and federal pollution control laws and regulations and to provide these managers with a better understanding of management problems associated with waste water treatment plant operations. The program will be offered in approximately ten sites throughout the state.

The Instructor Improvement Seminars have been organized to enhance the operator/instructor's teaching skills through better techniques of communication and instruction. Effective methods for presenting technical and difficult topics will be covered. The seminars are designed for approximately 35 hours of instruction with about 12 instructor-trainees per session.

The Entry Level Operator Training is designed for the inexperienced operator who needs the basics of waste water treatment plant operations. The course will emphasize practical knowledge and skills required to operate the plant. While the function of the program is not to assist the student in passing the Class I certification test, all the information contained in the class will be applicable to the certification requirements. However, the operator-trainee will be encouraged to attempt the certification test as an indicator of his competency as an operator. The instruction will concentrate on basic mathematics, elementary chemistry, biology, safety, operations and maintenance, laboratory testing and records.

The Operator Training, Skills Upgrading, is directed toward the needs of operators who have a general knowledge of the treatment plant but require additional skills to perform operational tasks in the most efficient manner. The training emphasizes the fundamentals of decision-making in solving and avoiding operational problems. In addition to classroom instruction, each trainee will receive 'hands-on' training and assistance with specific problems in his/her plant. They will be encouraged to establish definite operation and testing programs, and an active maintenance schedule.

In addition to the entry and upgrade operator training programs, a series of short courses, seminars, and workshops will be offered. These programs will focus on specific subjects or phases of the waste water treatment plant operation. Topics which are being considered for development include short courses on pump maintenance, flow measurements and sampling techniques for small plants, chlorination and disinfection equipment, lift station operation and maintenance, and package plant operations. The advanced operator training will be directed toward the Class III and IV operator. The training will be geared toward improving the operators skills in operating specific waste water treatment processes and equipment. The training will also seek to increase and widen the experienced operator's skills in the operation of the more advanced waste water treatment processes and equipment.

The Operator Training in the testing and laboratory procedures required for NPDES permit compliance will be divided into workshops which concentrate upon basic, nutrient and metal parameters. Instruction will consist of 'hands-on' laboratory sessions. All instruction will be consistent with EPA approved methods and procedures. Approximately 13 classes in the basic parameters, 6 classes in the nutrient constituents and 6 classes in metal analysis will be designed. An estimated 10-12 classes are required for flow measurements and sampling techniques.

The Indiana State Board of Health began waste water treatment plant operator training in 1969. The program was initiated through the use of MDTA training funds. During the first year of operation only 80 operators were trained; however, the enrollment has stabilized at 150-200 enrollees per year.

Other programs which are offered include three NDPES workshops, three maintenance workshops and two general operator upgrade training programs. The General Operator Upgrade Training Program is 48 hours, the Maintenance workshop is 36 hours, and the NPDES workshop is 36 hours.

During 1977, plans will be developed for an intensification of the waste water training programs in coal mining areas. There will be a course specifically developed for industrial waste water treatment plant operators in coal intensive industrial areas. It is anticipated that the course will be offered twice annually with an enrollment of 20-25 persons. The course will be offered for twelve weeks including 36 contact hours. This course was deemed necessary since there is a relatively high turnover among waste water employees in coal intensive areas.

In 1978, it is expected that a laboratory analysis course for waste water as it relates to effluent standards will be developed. The course will probably be offered five to six times per year for 36 contact hours. Preliminary projections indicated that as many as 100 persons may be trained during the year.

One area of planned expansion will be the maintenance training program. Within a year, five maintenance workshops will be developed.

The courses will focus on electrical equipment, yard and ground safety, chlorination equipment, processing equipment, lubrication and tools required for the job, and care of equipment. It is expected that the workshops will be offered five times per year with approximately 20 enrollees per class.

Three additional courses are currently being organized: a 48 hour basic math workshop, a 36 hour basic laboratory course, and a 36 hour metal analysis workshop. An estimated 175-260 persons will be trained through these programs.

The Community College System within Indiana is active in environmental education programming. The Gary Campus of IVY Tech (Indiana Vocational Technical School) offers a Pollution Control Technology course. The emphasis of the program is upon air and water pollution control skills. The program offers an Associate of Science degree. The program, created in 1974, recently graduated its first class of students. All 17 students in the first class have had jobs or offers three to five months prior to graduation. George Kinias, Director of the Environmental Education Program at Gary, predicts that an average of 16 to 20 students will be enrolled in the program. Over the next five years, the program is expected to grow from 25 to 30%.

Various environmental community service programs are offered throughout the state. Eight courses are offered each year:

1) review class for certification;
2) municipal waste water treatment plant operator;
3) industrial waste water treatment plant operator;
4) equipment maintenance;
5) NPDES training;
6) phosphorus removal;

7) activated sludge;
8) basic mathematics.

These courses are offered through the community colleges; however, not all community colleges offer the courses. Approximately 300 persons participate in the programs annually. An estimated 90% of the persons enrolled in the programs are currently working in the waste water treatment field. The remaining 10% are new entrants.

Over the next five years the participation in the community service programs is expected to grow by about 300-400%. Currently, such development has been limited as a consequence of limited instructional space. The programs expected to experience the greatest growth rate will be the water and waste water treatment courses. This growth will be related to the expansion of federal regulation expansion. In addition, two other factors will impact the growth in these programs:

1) projected expansion of municipal and industrial treatment facilities;
2) the average age of persons holding these positions is relatively 'high'; a great many of the persons will be retiring from the field in the near future.

The Gary Campus of IVY Tech has recently received a construction grant from U.S. EPA for the construction of an environmental teaching and waste water treatment facility. The site will be used for both industrial and municipal waste water treatment plant operator training. In addition, plans for the facility call for the treatment of an average of 10,000 gallons of waste water per day. Other training opportunities offered through the program will be mechanical and electrical equipment maintenance and repair.

One section of the Water Pollution Control Division is responsible for Waste Water Operator Certification. The one person program is currently responsible for offering programs for both municipal and industrial waste water. The certification programs began in 1974 with an average of two programs offered annually. There are approximately 1,064 industrial waste water plant operators currently certified. A majority of these positions were certified by virtue of the fact that they held the position prior to 1972. A significant proportion of these also held voluntary certifications prior to 1972. The following represents the number of industrial operators who have been certified through examination.

	1974	1975*	1976
Class A	44	26	32
Class B	49	20	38
Class C	46	20	36
Class D	29	12	25

*Only one program was offered in 1975.

Consideration is being given to offering two additional categories of certification: 1) stone and gravel washing and, 2) electroplating. These two types of treatment do not require the extent of knowledge or experience as the other classifications.

The Municipal Certification Program also began in 1974. The following chart represents the cumulative number of municipal plant operators that were certified for a given year. The rate of growth in the certification program is expected to continue at the same rate as has been experienced over the past few years.

	1974	1975	1976
Class I	611	775	861
Class II	305	367	413
Class III	105	185	212
Class IV	83	90	99
TOTALS	1104	1417	1585

E. Career Potential

The career prospects for all levels of personnel involved in Water Pollution Control are strong. The state program will be expanding its 208 Planning activities and its regulation and enforcement activities under PL 92-500. This expansion will result in a cumulative increase of 41% in the total staffing level of the department over the next five years. The greatest increase will be attorneys which is expected to triple.

The career potential for both municipal and industrial waste water treatment personnel is also very good. With the overall growth of the field by 300%, all levels of positions within the plants will be growing. This growth will not only provide for new entrants into the field but will support upward mobility within the field. Within the private sector there is an anticipated emerging demand for engineers and systems design specialist in waste water technology.

The career potential for all careers within both the private and public sector will depend largely upon federal, state, and local fiscal commitment.

F. Conclusion

During the next five years, the water pollution control field will experience a dramatic increase as the state responds to the demands of 208 Planning and PL 92-500. This rapid expansion will assert continuing demands upon the state training and certification programs. Advanced training programs will be called upon to educate chemists, engineers, biologists and systems designers in the fundamentals of waste water treatment. The vocational technical schools will be asked to train more operators, supervisors, laboratory technicians and maintenance workers. The state certification program will need to be expanded to meet the increased demands for certified personnel. Due to the rapid growth, extensive coordination will be required. The training programs should be coordinated with the certification program. Communication lines must be developed between the state agency and private sector to assure that the supply of personnel equals the demand, and, that the personnel are trained with the skills necessary to function on the job.

The state and local governmental agencies will be called upon to respond to increased fiscal demands. If the private sector grows at the rate predicted, the municipalities and state government will be required to commit large sums of money and resources. To assure that adequate finances are available as the demand emerges, the state agency might develop a long-range technical assistance planning program for municipalities to aid them in defining individualized municipal goals and organizing fiscal management programs to gain the requisite resources.

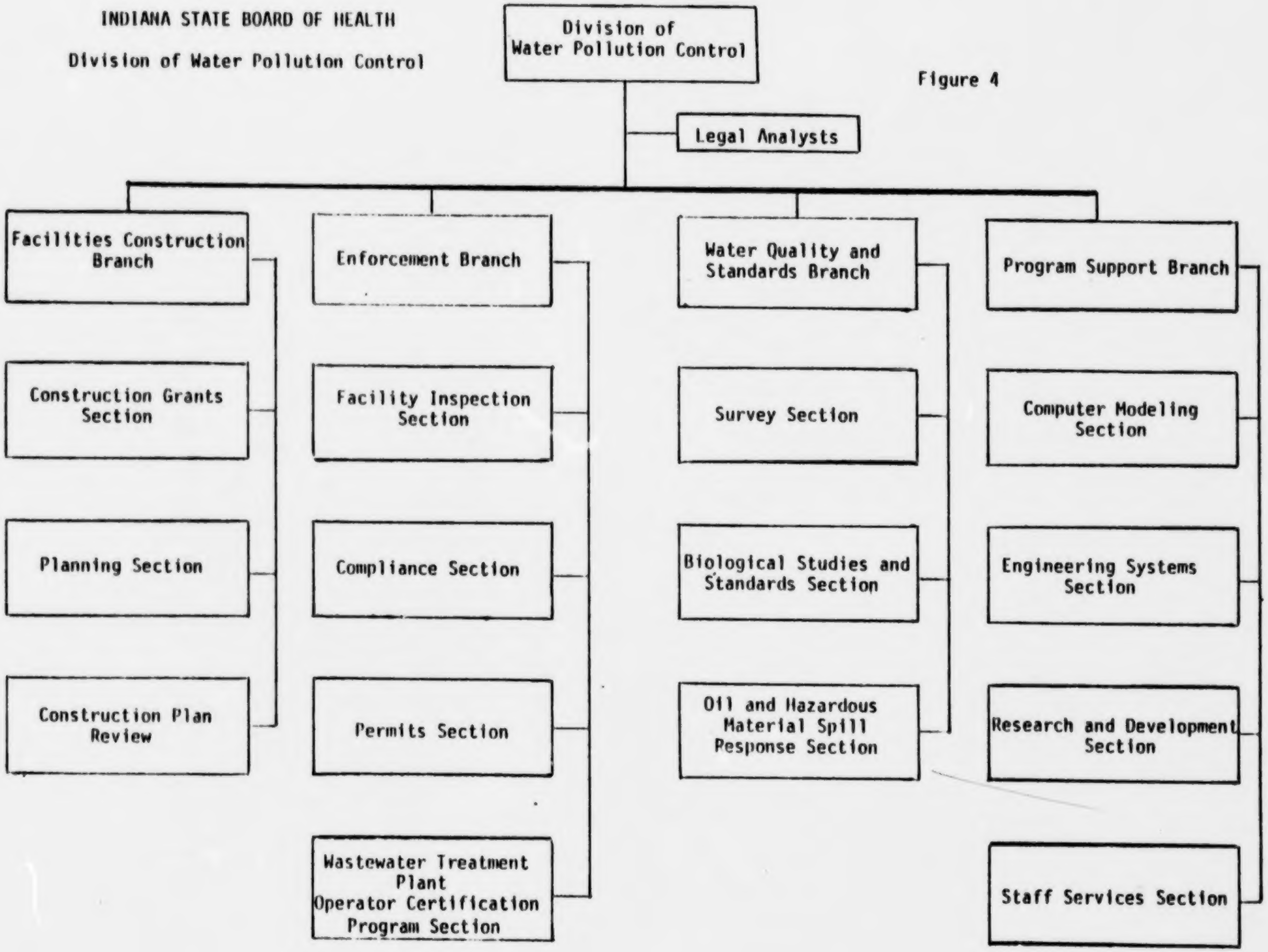
Overall, the waste water pollution control field is growing and this growth is expected to continue through 1982 at an annual rate of 7% for the state lead agency. The in-state personnel level is expected to triple over the next five years. This growth is attributed to increase enforcement and compliance activities within the state.

In conclusion, it is evident that the growth patterns in the waste water pollution control field are directly related to the requirements of federal legislation, i.e., PL 92-500 and 208 Planning. While there is no apparent emerging legislation in this field, any new legislation introduced during the next five years would certainly alter the workforce projections in that there would be a probable increase in all occupational levels in both the private and public sector.

INDIANA STATE BOARD OF HEALTH

Division of Water Pollution Control

Figure 4



Division of Water Pollution Control
Legal Analysts
Facilities Construction Branch
Construction Grants Section
Planning Section
Construction Plan Review
Enforcement Branch
Facility Inspection Section
Compliance Section
Permits Section
Wastewater Treatment Plant Operator Certification Program Section
Water Quality and Standards Branch
Survey Section
Biological Studies and Standards Section
Oil and Hazardous Material Spill Pesponse Section
Program Support Branch
Computer Modeling Section
Engineering Systems Section
Research and Development Section
Staff Services Section

VIII. ENERGY

A. Introduction

Indiana, as one of the top ten industrial states, has a significant interest in energy production and its concomitant environmental impact. In an effort to assess Indiana's future energy status, the Committee on Science and Society of the Indiana Academy of Science has recently completed a study on Indiana's energy resources entitled, Indiana Energy 1977: A Status Report with Suggestions for Policy Action. The report abstracts the state's status with regard to the various energy sources. The study also includes a series of recommendations for state action to assure a sound 'energy future'. While much of the information contained in the report is not directly related to energy/environmental workforce statistics, it is valuable in charting the economic future of the state. Sections of the report are included as an appendix to this section of the study.

The State of Indiana has a designated energy office; however, the agency has limited 'energy-related' functions. The primary responsibilities of the agency include:

1) administering the federal mandatory petroleum allocation program;
2) developing policies and programs to minimize the fuel shortage;
3) advising the legislature on energy-related policies;
4) encouraging public involvement in energy conservation programs;

5) monitoring and collecting data on other state programs and legislation.

6) developing a public relations program to inform the public and other state and local agencies of the status of energy programs in the state.

The Governor's office is also concerned with and involved in energy conservation programs. The primary function of the Governor's office has been to make policy statements regarding energy programs. In response to the impending future shortage of energy, the Governor's office created a "Governor's Pride Program" which is principally an effort to publicize the need for energy conservation on an individual and community basis. Thirty to forty communities have participated in the program.

While other agencies, specifically the Department of Natural Resources, the Public Service Commission, the Indiana State Board of Health, the Department of Commerce,and others, are involved with energy planning, no one agency with the state has complete responsibility for energy-related programs.

B. Workforce Profile

Up to now, energy programs in Indiana have not merged their functions into a single effort, therefore, a single assessment of their relative impact in the state presents some problems. Because of this fragmentation of responsibility, the workforce profile and projections for the state will focus on the State Energy Office.

The Energy Office is staffed with five professional and two clerical persons. One of the professionals has been delegated responsibility for the Governor's Pride Program. This position is considered to be basically public relations work, and consequently was staffed with an individual with experience in the public relations field. Another professional staff member is in charge of state energy conservation efforts and serves as a solar energy advisor. The person filling this position has experience in basic electronics. A third professional staff member is delegated authority for the mandatory petroleum program. The remaining two staff members are the director and assistant administrator whose responsibilities include diverse management and energy program activities.

During the last program year, two positions were eliminated from the staff due to budget reduction. Mr. William Watt, Assistant to the Governor, indicated that there may be a reorganization in the Energy Office. One plan under consideration is the reorganization of the office around a series of program priorities such as transportation, agriculture, industry, government operations, and the consumer. Under this program format, the office would function primarily as a planning and policy making office rather than in a public relations capacity. At this time, however, no specific plans have been developed to effect the reorganization.

The Energy Office recruits employees through the Department of Commerce and the State Personnel Office. Turnover within the department has been nil other than the two positions eliminated by budget cuts.

As with the state, the in-state workforce projections for the energy field are difficult to assess. Most utility companies within the state have environmental components. The utility companies generally have two types of environmental programs: air and waste water. The workforce projections for the utility companies have been merged with the projections of private industry within the air and waste water sections of this report.

C. Workforce Projections

Regardless of whether or not the Energy Office is reorganized, the office is expected to grow slowly. During the next five years, the office expects to increase by three professional positions. The three positions anticipated would include an engineer, a librarian and a computer specialist. The engineer would serve as a manufacturing liaison since it is believed that more effort should be directed toward provision of technical assistance to industry in the evaluation of their energy efficiency. The librarian would be in charge of categorizing and reviewing all energy related publications and materials. The computer specialist would be responsible for analyzing supply and consumption patterns within the state. It is anticipated that two of these positions would be added during fiscal year 1978-79, and the third would be added during fiscal year 1979-80. The department would then stabilize through 1982.

Construction of two nuclear power plants will have a major impact upon the workforce of the state. Collectively, the plants will employ up to 375 persons. Both plants are scheduled to begin operation during 1982. The Marble Hill Plant, which is to be located on the Ohio River twelve miles from Madison, Indiana, will have two units each producing

11,300 megawatts. The first generating unit is scheduled for operation in 1982 and the second unit will be functional by 1984. There will be approximately 175 persons on staff in 1982. The breakdown of the staff by occupation is as follows:

1) 12 graduate engineers
2) 15 instrument technicians
3) 8 health physics technicians
4) 25 quality control specialists
5) 27 electrical and mechanical maintenance workers
6) 1-2 biologists
7) 1-2 chemists
8) 6-7 chemical technicians
9) 10-20 equipment operators
10) 5-10 administrators, environmentalists, and personnel officers
11) 7 clerk/typists

At least 50% of the staff will be involved in some aspect of environmental quality control.

The Bailey Nuclear Plant is to be located in Plain Field on Lake Michigan (North Porter County about twelve miles from Gary, Indiana). Construction of this plant has been delayed by a major litigation action which was resloved only recently. The generating capacity of this unit will be 685 megawatts thermal gross. The plant will be staffed with approximately 125 persons. No exact breakdown is yet available on the staffing of the plant; however, available positions will include engineers, instrument technicians, health physics technicians, quality control specialists, electrical and mechanical maintenance workers, biologists, chemists and clerk/typists. There will be a supporting staff which will include administrative environmentalists. As with the Marble Hill Plant, a major portion of the staff will be involved with environmental quality control.

D. Training and Certification

There are no certification programs either currently operational or planned for personnel in energy-related environmental fields. Those persons who will be employed in the nuclear power plants will be recruited through a variety of sources: in-house transfers or promotions, colleges and universities with related programs, and through professional journals. Other than general biology, chemistry and engineering programs, colleges and universities have limited programs in energy/environmental fields.

E. Career Potential

With the limited availability of information concerning these programs, it is impractical to offer trends for career potentials in the energy conservation and conversion field. However, giving consideration to the growing energy shortage, it is reasonable to assume that while job opportunities may be declining in the traditional energy programs, there may be a considerable increase in the demand for all personnel levels with experience in nuclear energy. The extent of this demand will be equivalent to the availability of radioactive materials to power the plant.

F. Conclusion

Indiana has a progressive energy conservation public relations program; however, to ensure more efficient operation of broad spectrum energy programs within the state, a reorganization of the Energy Office is being considered. While the reorganization, itself, will not have a significant impact upon the workforce, growth within the department is expected. Notable among the positions being added is the computer specialist who will assist with developing a program for industrial/consumer consumption and supply analysis.

There will be growth within the private sector in the environmental/energy components of utility companies as a consequence of the construction of two nuclear power generating plants. There will be an increasing demand for personnel in all levels with experience and background in nuclear energy.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

The educational institutions within the State of Indiana offer an array of environmental education programs. Purdue, Indiana University, and Ball State University are notable for their degree and advanced degree programs. The state's four year institutions, in an effort to conserve financial resources, are actively coordinating and cooperating on specific training programs. A notable example of this cooperative instructional effort is the School of Public and Environmental Affairs of Indiana University.

The School of Public and Environmental Affairs is a multi-campus operation. It is currently operative on the Bloomington, Indianapolis, Northwest, Fort Wayne, and South Bend campuses of Indiana University. The enrollment, graduate programs, and curriculum offerings for the program offered through the Bloomington campus are defined in detail in the senior institution section of this report.

The community colleges and technical schools are following suit in coordination of training efforts. Outstanding for its efforts in the environmental field is Indiana Vocational Technical School in Gary, Indiana. The environmental program offers a diversified offering in its community education program and technical school core courses.

The Gary campus has recently received a grant from U.S. EPA to construct a water treatment facility and training laboratory. The laboratory will be utilized to centralize community education programs and technical training programs within the state. The Pollution Technology Treatment Program offered through the Gary Campus of Indiana Vocational Technical School is reviewed in the Community Colleges/Technical Institutions section of this study.

SENIOR INSTITUTIONS

Indiana University, Bloomington Campus
Bloomington, Indiana

Program: Public and Environmental Affairs (Cert., A.S., B.S., M.S., M.P.A., Ph.D.)
Staff Size: Three associate professors, two assistant professors, fifteen graduate assistants (5 Ph.D.)

Programs

Environmental Studies Certificate Program

Hours required for a major: Semester - Major 23-24.
Program Inception: 1973
Enrollment: 33
Graduates (1976): 7
Placements: no available information
Graduate Work: no available information

Associate of Science in Environmental Science

Hours required for a major: Semester - Major 60-64.
Program Inception: 1973
Enrollment: 0
Graduates (1976): 0
Placements: 0
Graduate Work: 0

Environmental Policy Concentraion in the Bachelor of Public Affairs

Hours required for a major: Semester - Major 120
Program Inception: 1972
Enrollment: 70
Graduates (1976): 16
Placements: 52 known placements
Graduate Work: no available information

Environmental Studies Double Major with the College of Arts and Science

Hours required for a major: Semester - Major 60-64
Program Inception: 1971
Enrollment: 35
Graduates (1976): 3
Placements: no available information
Graduate Work: no available information

Environmental Policy Concentration in the Master of Public Affairs

Hours required for major: Semester - Major - 18
Program Inception: 1974
Enrollment: 11
Graduates (1976): 2
Placement: 2
Graduate Work: 0

Master of Science in Environmental Science

Hours required for major: Semester - Major - 48
Program Inception: 1974
Enrollment: 50
Graduates (1976): 3
Placement: 3
Graduate Work: (Ph.D.) 1

Doctor of Philosophy Dissertation MInor in Environmental Science

Hours required for minor: Semester - Minor - 12
Program Inception: 1974
Enrollment: 7
Graduates (1976): 0
Placement: 0
Graduate Work: 0

Courses - Certificate

The Environment and Physics
Physical Systems of the Environment
Materials and Processes
Elements of Geology
Environmental Biology
Environmental Economics
Environmental Policy
Environmental Studies
Ecology
The Law and the Environment
Analytical Chemistry
Organic Chemistry
Public Finance
Resources and Population
Social Control of Industry
Environment and Man
Climatology
Environmental Conservation
Population Geography
Hydroclimatology

Advanced Physical Geography
Land Use Analysis
Environmental and Urban Geology
Mineral Resources
Introduction to Geochemistry
Principles of Geomorphology
Principles of Hydrogeology
Microbiology: Laboratory
Political Theory and Policy Analysis
Public Policy Analysis
Interpretive Resources and Techniques
Population
Topics in Social Organization
Urban and Regional Planning
Statistics
Limnology

Courses - Undergraduate

Environmental Biology
Environmental Policy
Environmental Studies Deminar
Law and the Environment
Resources and Population
Economic and Social Control of Industry
Man's Impact on the Environment
Introduction to Economic Geography
Environmental Conservation
Population Geography
Land Use Analysis
Interpretive Resources and Techniques
Population
Topics in Social Organization, Topic: Human Ecology
Ecology
Analytical Chemistry
Organic Chemistry
Climatology
Environmental and Urban Geology
Mineral Resources
Introduction to Geochemistry
Physics and the Environment
Environmental Physics
Limnology

Courses - Graduate

Applied Ecology
Environmental Physics
Analytical Chemistry

Climatology
Hydroclimatology
Environmental and Urban Geology
Principles of Hydrogeology
Public Management Economics
Public Management
Public Organizations and Social Systems
Public Finance and Budgeting
Environment and Social Systems
Environmental Systems Dynamics
Population and Natural Resources
Environmental Law
Law and the Environment
Law and Public Affairs
Public Policy and the Environment
Political, Economic and Regulatory Aspect of Environmental Control
Technology Assessment
Science, Technology, and Public Policy
Seminar in Environmental Biology
Environmental Analysis Workshop
Summer Flowering Plants
Advanced Field Biology
Environmental Microbiology
Entomology
Entomology Laboratory
Limnology
Stream Limnology
Production Limnology
Advanced Population Ecology
Advanced Field Biology
Photogrammetry and Remote Sensing
Land Use Analysis
Environmental and Urban Geology
Descriptive Meteorology
Energy and Materials Residuals
Advanced Physical Geography
Location Theory
Cartography and Graphics
Advanced Climatology
Advanced Cartography
Environmental and Urban Geology
Mineral Resources
Introduction to Geochemistry
Principles of Geomorphology
Principles od Hydrogeology
Introduction to Earth Physics
Economic Geology
Quarternary Geology
Surface Water Hydrology

Ground Water Hydrology
Industrial Minerals
Soil Geomorphology
Environmental Microbiology
Virology
Viral Medical Laboratory
Medical Microbiology
Microbial Ecology
Microbiology for Medical Students
Environmental Science
Urban and Regional Planning
Public Affairs and Environment
Regional Transportation Systems
Cartography and Graphics
Location and Regional Economics
Urban Physical Structure
Methods of Urban and Regional Analysis
Methods of Population Analysis and Their Application
Land-Use Control
Problems in Demography and Ecology
Problems and Policy for Urban Development
Advanced Urban Geography
Law of Real Estate and Land Use Control
Real Estate and Land Economics
The Transportation Dimension
Mineral Resources
Public Utilities Theory and Analysis
Problems in Public Utilities Regulation and Management
Technology Assessment
Topics: Energy Policy
Seminar in Public Transportation Policy
Science, Technology, and Public Policy
Coal Geology
Principles of Petroleum Geology
Research Systems and Technology
Public Law and Policy: Science and Society
Operations Management
Population and Resources
Social Control of Industry
Public Law and Policy
Natural Resources Law

COMMUNITY COLLEGES/TECHNICAL INSTITUTIONS

Indiana Vocational Technical School, Gary Campus
Gary, Indiana

Program: Pollution Treatment Technology (A.S.)

Hours required for major: Quarter - Major 81
Program Inception: 1974
Staff Size: Two Instructors (2 M.S.)
Enrollment: 18
Graduates (1976): 17
Placement: 17
Graduate Work: 0

Courses

Physical Science and Electricity
Introduction to Water Pollution Control
Technical Mathematics I, II
Basic Hydraulics and Water Control
General Chemistry and Microbiology
Basic Drafting
Sanitary Chemistry and Microbiology
Basic Surveying
Community Relations
Municipal Water and Wastewater Treatment
Instrumentation and Controls
Technical Communications
Special Problems (Field Study)
Industrial Water and Wastewater Treatment
Contracts, Specifications, Codes, and Estimates
Applied Research

State Legislation

INDIANA GENERAL

TITLE:

Environmental Management Act
Indiana Code 1971, 1307, as amended

PURPOSE:

To provide evolving policies of comprehensive environmental development and control; to unify, coordinate and implement programs for most beneficial use of resources; to protect and enhance the quality of the environment.

DEFINITIONS:

1. Board
2. Agencies
3. Person
4. Air Pollution
5. Contaminant
6. Garbage
7. Open burning
8. Open dump
9. Public water supply
10. Refuse
11. Sewage
12. Sewage works
13. Water pollution
14. Waters

ADMINISTERING AUTHORITY:

Indiana Environmental Management Board
Stream Pollution Control Board
Air Pollution Control Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To prepare long-term environmental program;
To conduct surveillance and inspection activities relating to refuse disposal, public water, pollution from radiation, noise or odor, and to assist local units in controlling such pollution;
To represent the state in federal environmental matters;
To assume the duties of the Board of Health set forth in the Refuse Disposal Act;

To administer discharge permit programs;
To restrict noise emissions;
To restrict radiation emissions;
To approve treatment plans for public water supplies.

CERTIFICATION OR LICENSING:

Permits may be required for control of water pollution, air pollution, garbage disposal, refuse disposal, noise, and atomic radiation. This includes construction, installation or modification of facilities; and discharge or operation permits.

PROHIBITED ACTS:

To discharge or emit contaminants or waste damaging to the environment or in violation of regulations;
To allow open dumping;
To alter any pollution control equipment or facilities;
To violate the conditions of discharge permits.

PENALTIES:

Civil penalties of up to $10,000/day; up to $500/hour for emergency order violations.

Criminal penalties of from $2,500 to $25,000/day or one year imprisonment for pollution; $1,000 to $5,000 or one year imprisonment for other violations.

INDIANA AIR

TITLE:

Indiana Air Pollution Control Law
Indiana Code Chapter 171

PURPOSE:

To maintain the purity of the air resources of the state, consistent with protection of public health and welfare, through the prevention, abatement and control of air pollution.

DEFINITIONS:

1. Control board
2. Person
3. Air pollution
4. Air contaminant
5. Air contaminant source

ADMINISTERING AUTHORITY:

Air Pollution Control Board
State Board of Health

AUTHORIZATIONS:

To make investigations and hold hearings;
To issue regulations pursuant to the act;
To encourage and assist air pollution control among local agencies;
To establish ambient air quality standards;
To limit motor vehicle emissions.

PROHIBITED ACTS:

To dismantle or remove motor vehicle pollution control devices;
To cause or allow air pollution contrary to regulations.

PENALTIES:

Fines of up to $500

INDIANA PESTICIDES

TITLE:

Indiana Pesticide Use and Application Law
Indiana Code 1971, 15-3-3.6

PURPOSE:

To regulate the use and distribution of certain pesticides.

DEFINITIONS:

1. Agricultural commodity
2. Animal
3. Beneficial insects
4. Board
5. Certified applicator
6. Private applicator
7. Commercial applicator
8. Defoliant
9. Desiccant
10. Device
11. Distribute
12. Environment
13. Equipment
14. Fungus
15. Insect
16. Licensed pesticide operator
17. Licensed applicator
18. Licensed public applicator
19. Nematode
20. Permit
21. Person
22. Pest
23. Pesticide
24. Plant regulator
25. Property
26. Restricted pesticide use
27. Unreasonable adverse effects on the environment
28. Weed
29. Wild
30. Certificate of financial responsibility
31. Registered pesticide dealer

ADMINISTERING AUTHORITY:

State Chemist
Pesticide Review Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To categorize certificates and licenses, and set forth applicator standards;

To issue applicator licenses;
To register restricted-use dealers;
To enter property for inspection and observation pursuant to enforcement activity;
To coordinate pesticide training activities.

CERTIFICATION OR LICENSING:

State Chemist shall establish standards for certification of pesticide applicators, to be met by examination. Pesticide operator, licensed applicator, private applicator, public applicator.

PROHIBITED ACTS:

To use or supervise restricted pesticides unless properly certified;
To sell restricted pesticides unless properly registered;
To violate the terms of a certification.

EXEMPTIONS:

Homeowners, veterinarians, researchers and farmers if in course of or incidental to normal actions. Farmers must be certified, not licensed, for restricted use pesticides.

PENALTIES:

Fines of from $1,000 to $5,000.

INDIANA PESTICIDES

TITLE:

Pesticides
Indiana Code 1971, 15-3-3.5

PURPOSE:

To provide for the regulation of the distribution, sale, and use of pesticides and to provide for the appointment of a Pesticide Review Board.

DEFINITIONS:

1. Active ingredient
2. Adulterated
3. Antidote
4. Board
5. Defoliant
6. Desiccant
7. Device
8. Distribute
9. Fungi
10. Fungicide
11. Herbicide
12. Highly volatile herbicide
13. Inert ingredient
14. Ingredient statement
15. Insert
16. Insecticide
17. Label
18. Labeling
19. Misbranded
20. Nematocide
21. Nematode
22. Person
23. Pesticide
24. Pesticides for use by prescription only
25. Plant regulator
26. Registrant
27. Restricted use pesticide
28. Rodenticide
29. Weed
30. Aquatic ecologist
31. Terrestrial ecologist

ADMINISTERING AUTHORITY:

State Chemist
Pesticide Review Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To accept registrations for all pesticides;

To designate restricted use pesticides and to limit their transportation and use;
To require proper labeling of pesticides.

PROHIBITED ACTS:

To distribute or sell unregistered pesticides, highly toxic pesticides, or misbranded, adulterated or improperly packaged pesticides;
To distribute or sell highly volatile herbicides;
To alter or deface pesticide labels.

EXEMPTIONS:

Qualified transporters, public officials, certain researchers, licensed veterinarians

PENALTIES:

Fines of from $1,000 to $5,000.

INDIANA POTABLE WATER

TITLE:

Certification of Water and Waste Water
Treatment Plant Operators Law
Indiana Code 1971, 13-1-6

PURPOSE:

To classify all water and waste water treatment plants and water distribution systems according to size, type, character and other physical conditions, and to require certain levels of skill, knowledge and experience of persons operating such facilities to protect the public health and prevent unlawful pollution.

DEFINITIONS:

1. Board
2. Commissioner
3. Operator
4. Waste Water treatment plant
5. Water supply system
6. Water treatment plant
7. Water distribution system
8. Effective date

ADMINISTERING AUTHORITY:

State Board of Health

AUTHORIZATIONS:

To certify operators based on qualifications;
To ascertain qualifications through examination or reciprocal arrangements with other states;
To issue regulations pursuant to the act, and particulary providing for classification of water or waste water treatment facilities and distribution systems.

CERTIFICATION OR LICENSING:

Certification of facility operators through examination or experience is required.

PROHIBITED ACTS:

To operate water facilities without properly certified personnel;
To perform operator duties without being certified.

PENALTIES:

Fines of up to $500.

INDIANA RADIATION

TITLE:

Radiation Control Act of Indiana
Indiana Code 1971, 13-1-2

PURPOSE:

To encourage the constructive uses of radiation and to control any harmful effects therefrom.

DEFINITIONS:

1. Radiation
2. Electronic product
3. Unnecessory radiation
4. Radiation machine
5. Radioactive material
6. Atomic energy
7. Special nuclear material
8. Source material
9. By-product material
10. Production facility
11. Utilization facility
12. Person
13. State Board
14. Advisory Commission
15. General license
16. Specific license

ADMINISTERING AUTHORITY:

State Board of Health
Radiation Control Advisory Commission

AUTHORIZATIONS:

Commission:

To act in advisory and review capacity to Board.

Board:

To investigate and inspect matters of radiation control;
To issue general and specific licenses for vaious radiation sources;

To issue regulations pursuant to the act;
To require plans concerning radiation shielding and radiation hazards;
To bring legal actions to enforce the act.

CERTIFICATION OR LICENCING:

General or specific licenses for use of by-product material, source material, special nuclear material or other radioactive material. Registration of other radiation sources required.

PROHIBITED ACTS:

To fail to have the necessary license;
To fail to register radiation sources for which no license is required;
To use radiation or fluoroscopic principles in fitting footwear.

PENALTIES:

Fines of from $500 to $1,000 and/or imprisonment up to 90 days.

NRC AGREEMENT STATE:

NO

INDIANA SOLID WASTE

TITLE:

Refuse Disposal Act
Indiana Code 1971, 19-2-1, as amended

PURPOSE:

To authorize counties, cities and towns to establish, acquire, construct, install, operate and maintain certain facilities for the collection and disposal of refuse and to declare open dumps to be inimical to human health.

DEFINITIONS:

1. Refuse
2. Garbage
3. Rubbish
4. State board
5. Refuse disposal facility

ADMINISTERING AUTHORITY:

State Board of Health
All counties, cities, and towns

AUTHORIZATIONS:

To establish and maintain refuse disposal facilities;
To contract for such disposal;
To provide financing for such facilities through user charges or taxation;
To issue regulations pursuant to the act.

PROHIBITED ACTS:

To finance refuse disposal facilities contrary to the act;
To establish or operate open dumps.

PENALTIES:

Prosecution under nuisance law;
Fines of from $100 to $500.

INDIANA WASTE WATER

TITLE:

Confined Feeding Control Law
Indiana Code 1971, 13-1-5.7

PURPOSE:

To define confined animal feeding operations and require approval of plans for treatment and control facilities for the operation of confined feeding operations.

DEFINITIONS:

1. Board
2. Waste treatment facilities
3. Confined feeding
4. Confined feeding operation
5. Operator
6. Person

ADMINISTERING AUTHORITY:

Stream Pollution Control Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To approve construction of all confined feeding operations;
To prevent pollution of the waters of the state.

PROHIBITED ACTS:

To construct a confined feeding operation without prior approval.

PENALTIES:

Fines of up to $100.

INDIANA WASTE WATER

TITLE:

Indiana Stream Pollution Control Law
Indiana Code 1971, 13-1-3

PURPOSE:

To create a Stream Pollution Control Board with authority to control and prohibit all water pollution within the state, and to provide for raising money for such purposes.

DEFINITIONS:

ADMINISTERING AUTHORITY:

Stream Pollution Control Board (including representatives from Department of Health and Department of Conservation)

AUTHORIZATIONS:

To control and prevent pollution in the waters of the state;
To bring legal actions to enforce the act;
To enter property for investigation and inspection purposes;
To issue regulations pursuant to the act, particularly designating water qualities indicating a polluted state;
To approve pollution abatement and correction plans.

PROHIBITED ACTS:

To pollute the waters of the state in contravention of determinations made by the Board;
To fail to correct or abate pollution as required by the Board.

PENALTIES:

Fines and civil penalties of from $25 to $100 and imprisonment up to 90 days.

INDIANA WASTE WATER

TITLE:

Phosphate Detergent Law
Indiana Code 1971, 13-1-5.5, as amended.

PURPOSE:

To control the sale and use of certain detergents.

DEFINITIONS:

ADMINISTERING AUTHORITY:

Stream Pollution Control Board

AUTHORIZATIONS:

To enforce provisions of the act;
To issue regulations pursuant to the act;
To allow the use of phosphates under certain circumstances.

PROHIBITED ACTS:

To use, sell, or dispose of into state waters detergent containing more than 8.7% phosphorus by weight after January 1, 1972;
To use, sell or dispose of into state waters detergent containing more than 0% phosphorus by weight after January 1, 1973.

EXEMPTIONS:

Detergents for food and dairy processing equipment, dishwashing machines, hospitals, and other uses in which the detergent does not enter the natural environment;

Fuel and lubricating oils.

PENALTIES:

Fines of from $100 to $1,000.

Appendices

INDIANA
SOLID WASTE COLLECTION SURVEY
1976

Prepared By:

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1977

COLLECTION SURVEY

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INDIANA
SOLID WASTE COLLECTION SURVEY
1976

Introduction

In late 1974, a statewide survey was first formulated to determine existing parameters of municipal solid waste collection in Indiana. Out of a total of 567 communities sent the first survey, 333 replied. The results of this survey were mailed to Region V, U.S. Environmental Protection Agency in late 1975.

In September of 1976, a new survey was formulated with the hope of overcoming some of the deficiencies contained in the first. Each question in the old survey was considered under the criteria: (1) clarity and (2) reality. If a question on the original survey was misinterpreted, some additional explanation was added. In other cases questions did not accurately reflect the real world situation. Those were deleted entirely or modified.

The Survey Form

The Collection Survey for this year was expanded to three pages. Each existing question was judged on the basis of the two criteria. Additional sections were added or modified to provide new information.

Under the first main heading Type of Residential Area Collection, the question concerning separate collection of garbage and rubbish was dropped entirely. Most of the responding communities in 1974 checked combined collection. It was thought that any community with separate collection would note this on the new survey form. By this same reasoning the questions regarding separate collection under Frequency of Household Refuse Collection and Type of Business and Commercial Collection were deleted.

Under Collection Equipment the column heading 'Type' was further clarified by giving examples of some common kinds of collection vehicles. In the "Capacity" heading the definition Volume was added to avoid the preponderance of weight related answers received in the first survey. A completely new category "Year Purchased" was added to get some idea of the age of the equipment being utilized.

A completely new topic Collection Budget was added to the new survey. This incorporated the monetary inquiry in the first survey and requested a 1977 projection. The 1976 budget was then broken down into specific categories. If a municipality contracted its collection responsibility to a private firm, it was intended that the entire amount reported under "Budget for 1976" be again recorded under "Collection Contract Amount." If a municipality collected its own solid waste, four categories were provided to further breakdown the 1976 budget--Salaries; Amortization of Equipment; Fringe Benefits, Insurance, etc.; and Other. An additional space was added to specifically denote disposal costs if known. Finally, an additional choice of revenue sharing was added to the question regarding the specific financing mechanism used to pay for collection.

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As a final improvement to the survey form the telephone number of the individual filling out the form was requested.

As a further help to those communities with a 1970 population of less than 10,000 persons, an example sheet for the mythical town of Smallville was included. A hypothetical situation was postulated and the resulting survey form was completed. A copy of the example is attached.

Implementation

A copy of the 1974 Collection Survey was mailed to every city or town clerk in Indiana without regard to a community's size. Approximately 59% of the completed surveys were returned.

In the 1976 survey two basic changes in respondent were introduced. First, surveys were only mailed to those communities with a 1970 population of greater than 1000. In the 1974 survey, nearly all communities with less than 1000 population reported that refuse disposal was the responsibility of each citizen. It was assumed that this situation continued to exist in 1976. This reduced the total number of mailings to 276.

The second basic change involved who would be required to complete the survey form. As previously stated, the 1974 Survey was mailed to the community's clerk or clerk-treasurer. When feasible in 1976, the city engineer of a municipality was mailed the survey. Of the 276 surveys mailed out, 50 were sent to city engineers. Of these 50, 30, or 60 percent were returned. This compared with the total return of 181 questionnaires, or 65 percent.

Viewed another way, this 60 percent return was a decline over the 1974 results. Of the 50 cities with city engineers, 42 returned the survey in 1974 but only 30 returned the 1976 survey. For future surveys it will not be assumed that an engineer would necessarily be better able to complete the survey.

The 1000-2000 Population Range

Of the 276 survey forms sent to Indiana communities, 98 were sent to towns with an estimated 1975 population between 1000-2000. Of these 98 forms, 75 were returned. Because of the smaller size of these communities it was decided to discuss their results under a separate paragraph form.

Table 1 groups the Type of Residential Collection reported by each community. It was assumed that because of the towns' relatively small size, refuse removal would be the individual's responsibility. As shown in Table 1, though, more than half the reporting communities took on the responsibility for collection themselves.

The one town listed under Other reported that they had no sewage system but were requesting funds for installation. This only serves to show that no matter how carefully a survey is constructed someone will misunderstand its intent.

Residential Collection Type - Table 1

Municipal Service	Private, Municipal Contract	Private, Individual Contract	Individual Responsibility	Other
14	28	15	17	1

Of the towns reporting a municipal collection service, only eight reported budget figures. The range of the 1976 budgets were $5,800-25,000 with an average budget of $13,000 and a median figure at $12,800. For the 1977 proposed budget the range was $4,800-25,000 with an average budget of $13,200 and a median budget of $15,000. Nine of the 13 towns used packer trucks with a capacity between 10-20 yards[3].

Of the 28 towns contracting with a private firm for collection 27 reported budget figures. These were of two types for 1976: the amount budgeted and the actual contract amount. Money budgeted for 1976 ranged from $2,600-38,500 with an average budget of $11,470 and a median of $10,000. The actual contract reported by 21 of the 28 towns ranged from $3,900 to $38,500 with an average contract of $10,860 and a median value of $9,561. For the proposed 1977 budget the reported values ranged from $2,600 to $43,000 with average and median values of $21,190 and $11,200, respectively.

All figures bear out what has been noted elsewhere--collection costs are rising. Not one Indiana town with a population of 1000-2000 providing refuse collection for its residents reported a decrease in the cost of such a service.

It should be further pointed out that the average and median reported values for towns contracting with private firms were both lower than the comparable values for towns performing their own collection.

Results

Tables 1-5 record the survey results for those responding Indiana communities with a population greater than 2000. As was evidenced on the 1974 survey, a wide range of costs were reported.

Many Indiana communities could not or did not give accurate budgetary figures. In some cases figures for collection were combined with other departments so only the total figure could be reported. In other instances only salaries and fringe benefits were reported. Equipment amortization and operational costs were not even considered. A town proud of its low collection costs would do well to examine its accounting system before gloating to an informed public.

In population range 2000-5000 (Tables 1A and 1B) 1976 costs per citizen in a community providing a collection service ranged from $4.25 to $27.36 with an average cost per citizen of $12.83 and a median value of $11.43. Communities contracting with a private collection firm reported values ranging from $2.66-$11.81 per citizen with an average of $6.27 per citizen and a median value of $5.47.

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In the population range 5,000-10,000 (Tables 2A and 2B) 1976 costs for communities providing a collection service ranged from $2.81-$12.86 per citizen with an average cost of $6.20 and a median value of $6.29. It should be noted here that the second and third lowest figures given in this cost range were derived from figures denoted "Salaries only" on the survey sheet. It should be safe to assume that the low figure of $2.81 per citizen in this range also ignores equipment and maintenance costs. Disregarding these low figures $4.53 per citizen becomes the lowest reported figure with new average and median figures of $7.14 and $6.46 per citizen, respectively. These new figures will be used in future determinations.

Of the four communities in the above population range reporting a municipal contract only two presented usable figures. These are not enough to indicate true costs.

In the population range 10,000-20,000 (Tables 3A and 3B) 1976 costs for communities providing a collection service ranged from $4.01 to $31.51 per citizen with an average cost of $9.30 per citizen and a median value of $5.89. Communities contracting out to private collectors reported costs from $3.68 to $7.67. The average and median values for these communities were $5.35 and $5.40, respectively.

Those communities in the population range 20,000-35,000 (Table 4) utilized only municipal collection of residential solid waste. No communities in this range reported a municipal contract. The 1976 costs for this service ranged from $6.16 to $16.27 per citizen with an average cost of $9.19 per citizen and a median cost of $8.04.

The final population range (Table 5A and 5B) contains municipalities with 35,000 to 250,000 citizens. The 1976 cost for those communities collecting their own refuse ranged from $3.41 to $15.35 per citizen with average and median costs of $7.12 and $3.76 per citizen, respectively. The figures reported by the City of Gary were not included in these compilations because they were obviously under-estimated. For the reported figures the 1976 cost per citizen would be less than $1.00 and the annual income of a sanitation worker would be less than $4000.

These communities contracting with private firms reported costs per citizen ranging from $5.61 to $9.18 with an average of $7.25 per citizen and a median of $6.62.

Tables 2 and 3 summarize the cost range, average and median for each population grouping.

Collection Cost - Table 2
Municipal Collection

Community Size	Cost Per Citizen Range	Average	Median
2,000-5,000	$4.25-$27.36	$12.83	$11.43
5,000-10,000	$4.53-$12.86	$7.14	$6.46
10,000-20,000	$4.01-$31.51	$9.30	$5.89
20,000-35,000	$6.16-$16.27	$9.19	$8.04
35,000-250,000	$3.41-$15.35	$7.12	$3.76

Collection Cost - Table 3
Municipal Contract

Community Size	Cost Per Citizen Range	Average	Median
2,000-5,000	$2.66-$11.81	$6.27	$5.47
5,000-10,000	—	—	—
10,000-20,000	$3.68-$7.67	$5.35	$5.40
20,000-35,000	—	—	—
35,000-250,000	$5.61-$9.18	$7.25	$6.62

Conclusions

The 1976 survey was a definite improvement over previous attempts at identifying the relative costs of municipal refuse collection practices in Indiana. Questions were brief and to the point, requesting information which should have been available in a clerk-treasurer's or city engineer's office. The inclusion of an example sheet for smaller communities should have ensured that everyone understood what was requested.

The overall response to the survey was quite satisfactory. Numbers reported seemed to make sense in most cases. The addition of the breakdown of a municipality's collection budget enabled the reviewer to identify the communities where "budget" equals salaries. These cases are noted in the tables.

Both average and median costs for contractual collection were very close within each population range. Thus there were few extreme cases within each range which would have affected the average figure. The profit motive could explain why the median for municipal collection in some cases is smaller than that for contractual collection. Communities collecting their own refuse need not add the extra charge for profit that private firms must. However, a number of communities provide twice per week collection.

TABLE 1A
Municipal Collection Service
Population 2,000-5,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Attica	Fountain	1	0	2	$ 30,000	-	$ 30,000	4,224	$ 7.10
Batesville[3](12%)	Ripley	0	1	2	6,500	-	-	4,039	13.41
Berne	Adams	1	0	2	30,000	$ 8,600	31,000	3,171	9.46
Brookville[8]	Franklin	1	0	3	6,000[4]	-	6,000	3,005	-
Cannelton	Perry	0	2	2	25,540	-	20,540	2,530	10.09
Centerville	Wayne	1	1	4	9,700[5]	-	10,100	2,381	-
Columbia City	Whitley	1	0	3	39,905	3,000	41,590	4,966	8.04
Covington[8]	Fountain	1	-	3	19,787	3,000	27,332	2,584	7.65
Delphi	Carroll	1	1	5	37,550	3,000	40,646	2,614	14.36
French Lick[8]	Orange	2	0	6	59,080	-	57,400	2,113	27.36
Greentown	Howard	1	1	3+	25,500	-	30,000	2,231	11.43
Lawrenceburg[8]	Dearborn	2	0	6	101,300	15,000	110,000	4,460	22.71
Newburgh	Warrick	2	0	5	-Sewer/ Sanitation Budgets Combined-				
North Vernon	Jennings	2	0	4	91,427	-	128,350	4,724	19.35
Paoli	Orange	1	0	3	29,500	-	36,000	3,567	8.27
Rensselear	Jasper	3	0	3	53,694	22,000	58,360	4,662	11.52
Scottsburg[8]	Scott	4	0	8	70,490	-	75,600	4,870	14.47
Tipton[8]	Tipton	1	4	14	58,500	16,600	75,020	4,970	11.77

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TABLE 1A (Con't)

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Schererville[6] (75%)	Lake	1	1	3	$ 61,105	$ 2,000	$ 67,250	4,105	$14.89
Southport	Marion		- Served by the Indianapolis Sanitary Department -						
Sullivan[7] (90%)	Sullivan	1	0	3	19,280	1,344	19,380	4,539	4.25
Winamac[8]	Pulaski	1	0	2	35,000	11,250	40,000	2,358	14.84

1 - Cost of Landfill

2 - 1976 Collection Budget divided by 1975 Derived Population

3 - Town collects 12% of residences

4 - Salaries only

5 - Salaries plus fringe benefits

6 - Town collects 75% of residences

7 - Town collects 90% of residences

8 - Twice per week collection

TABLE 1B
Municipal Contract with Private Firms
Population 2,000-5,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Collection Contract	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[1]
Aurora	Dearborn	-	-	-	$ 47,500	$ 47,500	$55,000	4,382	$10.84
Batesville[2](88%)	Ripley	-	-	-	48,500	42,000	48,500	4,039	11.81
Bremen	Marshall	1	0	2	18,000	18,000	20,000	3,713	4.85
Butler	DeKalb	-	-	-	19,680	19,680	20,160	2,509	7.84
Fortville	Hancock	-	-	-	20,000	20,000	24,000	2,592	7.72
Fowler	Benton	-	-	-	8,500	-	9,300	2,722	3.12
Garrett	DeKalb	-	-	-	35,000	32,750	35,000	4,897	6.69
Ligonier	Noble	-	-	-	17,900	-	17,900	3,271	5.47
Nappanee	Elkhart	2	0	3	19,000	18,500	20,000	4,296	4.31
New Whiteland	Johnson	-	-	-	37,500	37,500	42,500	4,589	8.17
Pendleton[4]	Madison	-	-	-	17,540	17,540	20,040	2,129	8.23
Porter	Porter	2	1	7	13,584	13,584	15,382	3,564	3.81
Rising Sun	Ohio	4	0	16	27,028	27,028	27,028	2,343	11.54
Schererville[3](25%)	Lake	-	-	-	61,105	10,925	67,250	4,105	2.66
Sheridan	Hamilton	1	0	2	5,950	5,950	5,950	2,123	2.80
Spencer	Owen	1	0	2	7,200	7,200	7,200	2,357	3.05
Trail Creek[4]	LaPorte	-	-	-	47,696	(1976-77 contract)		3,424	6.96
Upland	Grant	-	-	-	12,000	12,000	1,200	3,942	3.04

1 - 1976 Collection Contract divided by 1975 Derived Population

2 - Batesville reported 88% contracted, 12% municipal service

3 - Schererville reported 25% contracted, 75% municipal service

4 - Twice per week collection with [illegible] variation

TABLE 2A
Municipal Collection Service
Population 5,000-10,000

City or Town	County	Number Packer Trucks	Number Other Vehicles	Number Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Charlestown	Clark	1	1	6	$ 43,000	$ 6,000	$ 46,000	5,974	$ 7.20
Decatur	Adams	1	0	4	66,205	23,040	72,800	8,505	7.78
Dyer	Lake	3	0	3	29,350[3]	12,540	54,958	8,208	3.57[3]
Edinburg	Johnson-Bartholomew	2	0	3	36,260	8,000	37,000	5,617	6.46
Greencastle	Putnam	1	0	3	25,370	-	26,390	9,029	2.81
Greensburg	Decatur	1	0	2	41,800	-	47,350	9,224	4.53
Hartford City	Blackford	1	0	2	24,000[3]	3,700	-	8,284	2.90[3]
Jasper[4]	Dubois	2	0	6	124,932	-	134,119	9,711	12.86
Lebanon[4]	Boone	2	0	6	62,163	10,000	60,243	9,889	6.29
Linton	Greene	1	0	3	- Not budgeted -			5,310	-
Plymouth	Marshall	1	0	3	57,854	5,000	53,000	7,712	7.50
Rushville	Rush	1	0	3	31,960	-	33,210	6,408	4.99
Salem	Washington	2	0	3	41,684	5,300	38,957	5,323	7.83
Winchester	Randolph	1	0	3	32,240	910	27,656	5,370	6.00

1 - Cost of Landfill

2 - 1976 Collection Budget divided by 1975 Derived Population

3 - Salaries only

4 - 75% municipal service, 25% individual contracts

TABLE 28
Municipal Contract with Private Firm
Population 5,000-10,000

City or Town	County	Number Packer Trucks	Number Other Vehicles	Number of Collection Employees	1976 Collection Budget	1976 Collection Contract	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[1]
Auburn[3]	DeKalb	- City pays contractor $1.02 per household per week -						7,866	-
Bluffton	Wells	2	0	5	$ 48,300	$ 48,300	$ 51,000	9,472	$ 5.10
North Manchester	Wabash	1	0	1	27,600	27,600	28,000	6,597	4.18
Plainville	Daviess	0	1	1	1,500	1,040	1,500	9,863	-[2]

1 - 1976 Collection Contract divided by 1975 Derived Population

2 - Reported Budget is too small to be considered correct

3.- twice per.week collection

TABLE 3A
Municipal Collection Service
Population 10,000-20,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Bedford	Lawrence	3	11	31	$282,232	-	$296,267	13,118	$31.51
Beech Grove	Marion	2	1	8	91,000	$ 20,000	99,000	15,441	5.89
Connersville	Fayette	3	0	6	150,061	36,700	118,050	17,558	8.55
Crawfordsville	Montgomery	2	0	6	71,514	-	67,676	13,850	5.16
Griffith	Lake	4	0	11	70,295	-	76,080	17,541	4.01
Madison	Jefferson	3	2	8-10	130,000	35,000	140,000	14,520	8.95
Martinsville	Morgan	2	1	9	105,200	-	105,560	10,963	9.60
Peru[3]	Miami	5	0	15	68,370	-	78,802	13,983	4.89
Wabash	Wabash	-	-	-	76,700	12,000	88,600	13,769	5.57
Washington	Daviess	-	4	11	103,585	-	110,585	11,620	8.91

1 - Cost of landfill

2 - 1976 Collection Budget divided by 1975 Derived Population

3 - twice per week collection

TABLE 3B
Municipal Contract with Private Firm
Population 10,000-20,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Collection Contract	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[1]
Crown Point[2]	Lake	-	-	-	$118,000	$118,000	$120,000	15,394	$ 7.67
Goshen	Elkhart	-	-	-	86,554	86,554	97,502	19,090	4.53
Logansport	Cass	-	-	-	100,885	100,885	100,885	18,371	5.49
Noblesville	Hamilton	-	-	-	55,000	55,000	72,600	10,189	5.40
Speedway	Marion	-	-	-	67,680	67,680	67,680	18,370	3.68

[1] - 1976 Collection Contract divided by 1975 Derived Population

[2] - twice per week collection

TABLE 4
Municipal Collection Service
Population 20,000-35,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Columbus	Bartholomew	13	0	39	$500,374	$106,000	$537,952	30,745	$15.27
Highland	Lake	5	0	15	287,851	55,600	279,149	30,188	9.54
Jeffersonville	Clark	4	0	12	262,058	70,000	267,576	20,254	12.94
LaPorte	LaPorte	5	2	21	182,236	60,000	182,236	22,543	8.08
Munster[3]	Lake	4	0	12	189,000	-	200,000	20,673	9.14
New Castle	Henry	3	3	18	145,000	33,000	211,000	21,658	6.69
Portage	Porter	3	0	9	147,260	14,000	152,152	21,710	6.78
Valparaiso[3]	Porter	6	0	12	188,000	21,000	186,000	20,688	9.09
Vincennes	Knox	6	0	18	150,986	20,821	150,986	20,821	7.25
West Lafayette[3]	Tippecanoe	3	0	9	125,577	-	128,079	20,372	6.16

1 - Cost of landfill

2 - 1976 Collection Budget divided by 1975 Derived Population

3 - twice per week collection

TABLE 5A
Municipal Collection Service
Population 35,000-250,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Disposal Cost[1]	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[2]
Bloomington[3]	Monroe	5	0	15	$169,000	-	$161,000	49,552	$ 3.41
Elkhart	Elkhart	7	0	21	372,692	$ 28,000	355,980	44,641	8.35
Gary	Lake	20	0	40	159,031	-	187,000	173,974	-
Kokomo	Howard	11	0	33	358,571	160,000	731,653	42,519	8.43
Marion	Grant	5	0	15	138,242	-	144,541	40,503	3.41
Muncie	Delaware	14	0	42	1,064,152	130,000	1,108,518	69,319	15.35
South Bend	St. Joseph	8	1	16	459,036	40,000	381,664	122,239	3.76

1 - Cost of landfill

2 - 1976 Collection Budget divided by 1975 Derived Population

3 - Twice per week collection with seasonal variation

TABLE 5B
Municipal Contract with Private Firm
Population 35,000-250,000

City or Town	County	Number Packer Trucks	Number Other Trucks	Number of Collection Employees	1976 Collection Budget	1976 Collection Contract	1977 Proposed Budget	1975 Derived Population	1976 Cost Per Citizen[1]
Anderson[2]	Madison	7	0	14	$472,180	$472,180	$472,180	84,152	$ 5.61
Evansville	Vanderburgh	-	-	-	1,169,000	1,169,000	1,200,000	137,388	8.51
Fort Wayne	Allen	30	0	90	1,232,122	1,232,122	1,598,888	185,991	6.62
Mishawaka	St. Joseph	-	-	-	336,395	336,395	336,395	36,629	9.18
Terre Haute	Vigo	11	0	3	439,284	439,284	455,804	69,196	6.35

1 - 1976 Collection Budget divided by 1975 Derived Population

2 - twice per week collection

INDIANA ENERGY 1977

A Status Report with Suggestions for Policy Action

The Annual Report
of the
Committee on Science and Society
of the
Indiana Academy of Science

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CHAPTER 2

INDIANA ENERGY

Rather than restating energy consumption by consuming sector and fuel or reviewing widely publicized data on declining reserves, the thrust of this chapter is to describe the present situation for the major components of Indiana's energy system, noting in particular the status and future prospects of potential alternatives to those fuels now in common usage*. While our time frame is deliberately vague, the situation will be much as we describe through at least 1980 because the lead times necessary to affect major alterations are typically long. Beyond that time the situation as viewed from the present is progressively less clear.

ENERGY CONSERVATION

Energy conservation measures offer immediate possibilities to alleviate near-term shortages of domestic fossil fuels. It is generally recognized that the only other means of offsetting such shortfalls is with imported oil, a strategy with obvious problems in view of the nation's current import rate.

Energy conservation, while it is equivalent to a once-only reduction in consumption, offers the potential for substantial fuel savings, dollar economies, and environmental benefits. Unlike other alternatives, the conservation option offers the opportunity for broad public participation and direct, highly visible action on the part of governmental units at all levels with some benefits accruing directly to consumers. On balance, it must also be noted that certain conservation measures might be implemented via price manipulation, a strategy that would increase energy unit costs for consumers. Among the areas where substantial savings can be realized are transportation (e.g., enforced speed limits, tax incentives for smaller engines), residential and commercial uses (e.g., more efficient applicances, improved insulation), and recycling (particularly energy-intensive and petroleum-based materials).

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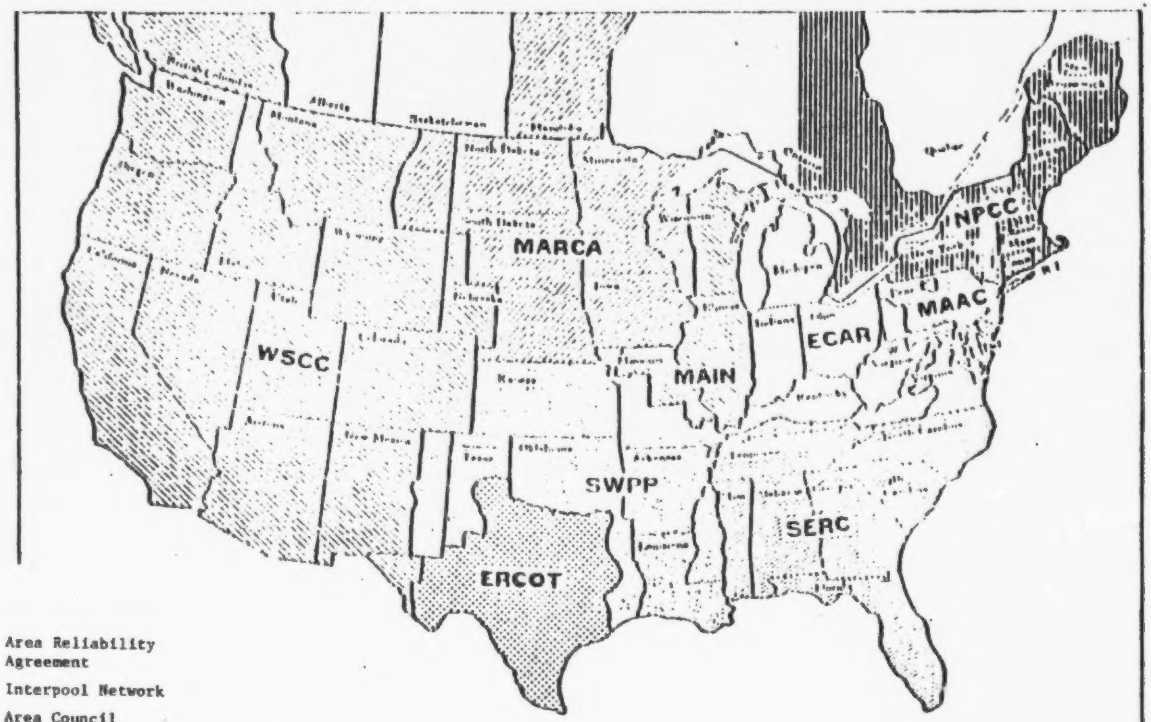
*In this section the panel made considerable use of the report "Indiana Natural Gas: Accommodation tc Reality" and acknowledges with appreciation the contributions of the task force members who prepared that document. A listing of the task force membership appears in Appendix D.

ELECTRICITY: GENERATION CAPABILITY AND NUCLEAR PROJECTIONS

The electric utilities in Indiana are included within the East Central Area Reliability Coordination Agreement (ECAR), one of nine regional reliability councils encompassing nearly all of the power systems of the U.S. and a large fraction of those in Canada. (See Figure 1.) Interconnections between regions are available, so that the future adequacy of electric power in Indiana is likely to depend strongly on the adequacy of regional and national generating capacity. Nevertheless, Indiana policies relative to the construction of new generating capacity will influence the extent to which Indiana can supply its own share of electricity in the future. For example, pioneering State policy regarding the consumptive use of water will have the effect of restricting most new capacity to the Ohio and lower Wabash Rivers.

On a national basis, and therefore on a State basis as well, there is so much uncertainty regarding generation capacity additions and future



REGIONAL ELECTRIC RELIABILITY COUNCILS

Figure 1

Source: FPC

ECAR - East Central Area Reliability Coordinating Agreement

MAIN - Mid-American Interpool Network

MAAC - Mid-Atlantic Area Council

MARCA - Mid-Continent Area Reliability Coordinating Agreement

NPCC - Northeast Power Coordinating Council

SERC - Southeastern Electric Reliability Council

SWPP - Southwest Power Pool

ERCOT - Electric Reliability Council of Texas

WSCC - Western Systems Coordinating Council loads that there can be no assurance that shortages may not begin to develop in the late '70's and early '80's. Current plans for power plant construction during the next decade are expected to result in an annual capacity increase averaging about 5.3% for the 48 contiguous states of the U.S. and about 4.7% for ECAR. But the current load projections for summer load peaks, including the conservatism resulting from the recession, increase at an average rate of about 6.4%, both for the nation as a whole and for ECAR. Therefore, if these numbers should turn out to be correct, a gradual reduction in reserve capacity will occur from the current 32.5% to 14.7% by 1985. This reduction would inevitably be accompanied by an increasing lack of system reliability and by electrical energy deficiencies with potentially serious economic and social consequences.

Most of the new electric generating capacity that is planned for the next decade is for coal-fired and nuclear plants. Oil-fired capacity is expected to increase slightly and then level off; natural gas-fired generation, primarily in Texas and neighboring states, is projected to decline. The increase in coal capacity averages about 5.8% per year nationally compared with only about 3.3% for ECAR. Projected increases in nuclear capacity average about 17% per year nationally compared with more than 23% for ECAR.

The planned expansion of both coal-fired and nuclear plants should be regarded as lower limits. It would be prudent to increase both, if possible. An excess of capacity would be far less risky to Indiana residents and much easier to correct. Both nuclear and coal-fired capacity expansions are subject to such constraints that a policy of dropping back on one by increasing the other would in all likelihood increase the threat of brown-outs and serious deficiencies of electric power. Accompanying the capacity expansion, consideration should also be given to the introduction of new energy storage technologies and rate structure changes as means of reducing projected increases in peak capacity requirements.

SOLAR ENERGY

Indiana's solar flux is sufficiently large to justify continued active development of this resource, especially for use in space heating and air conditioning and in domestic hot water heating. However, the variability of the flux is such that this application will require storage and backup systems. Large scale solar electric power generation will not be attractive in Indiana without major advances in conversion and storage technologies. Table 1 illustrates the average solar flux in Indiana by month.

Table 1.

Average Solar Flux on Collector
Surface Which is 50° from the Horizontal
(BTU/sq ft/day)

January	1067	July	1581
February	1224	August	1625
March	1438	September	1823
April	1392	October	1682
May	1439	November	1296
June	1493	December	1084

Solar energy in Indiana may not only replace some nonrenewable fuels but, because of the requirment for storage systems, it also has the potential to help alleviate the peak load situation facing the electric utilities. For example, thermal storage systems can be used to "store" air conditioning during the peak demand periods in the summer. Thus, air conditioners in solar homes could be run at night and operated at reduced levels or even turned-off during the day when the heaviest electricity demand usually occurs. A similar procedure could be followed for heating systems in the colder months. The procedure in the latter case would be to keep a high percentage of thermal storage capacity in place during the day, even if the solar system is not fully operational. In this manner the solar energy system's storage unit assists in reducing the electrical system's required peak generating capacity.

Because of the high solar flux and the required emphasis on thermal storage, Indiana and neighboring states have the potential to become leaders in solar heating and air conditioning demonstration projects, technology development, and applications. Among the more important areas in which technological development will be important are low-temperature air conditioner systems, solar space heating and domestic hot water systems suitable for retrofitting existing structures, thermal storage systems, auxiliary systems for solar applications such as controls, insulated ducting and low-cost valves, and lower solar collector costs through simpler design, mass production, and on-site construction.

NATURAL GAS PRODUCTION IN INDIANA

Unless major new reserves of natural gas are discovered in Indiana, the State must continue to rely upon gas brought in by long-distance pipelines from the South and Southwest. Present in-state reserves amount to only about 1 percent of the State's annual consumption. Production from Indiana wells last year would have satisfied the State's consumption for 5 hours.

ACCESS TO NATURAL GAS FROM OUT-OF-STATE SOURCES

Indiana is favorably situated to receive gas from the principal producing regions in the United States, as trunklines from the south and west cross or pass near the State enroute to major consuming regions farther north and east. Proposals now under active review to bring Alaskan gas to the lower 48 states may well result in additional service to the Midwest, including Indiana, from that source. The reduced availability of gas that has been experienced in the past three years and which may be expected to become progressively more acute for the foreseeable future results primarily from declining production at the sources rather than from any inadequacy in the interstate distribution system. A complicating factor, however, is federal price control at the wellhead of gas sold in the interstate market. Some effects of price regulation have been to restrict the availability of gas outside the principal producing states, to encourage use of gas in place of other fuels, and to reduce production. A further complicating factor for Indiana is the varying curtailment levels and differing mixes of priority users across the State leading to inequitable distribution resulting in gas surpluses in some areas and shortages in others. The average 5% annual decline in deliveries to Indiana over the next several years may be expected to amplify those inequalities in the absence of mitigating action by the State or federal government.

UNDERGROUND STORAGE OF NATURAL GAS

Large volumes of natural gas stored in porous and permeable sandstone and limestone reservoirs were originally developed to serve as a cushion against fluctuating demand and to permit the local warehousing of gas at times when it was available and the price was low. Indiana has more than 30 such storage reservoirs, and they have performed a valuable service both in making gas more available during periods of high use and in reducing the cost to the consumer. They are based, however, on the concept of gas available in large volume and at low cost. This situation no longer exists, and the storage facilities, which have never been filled to their capacity, are no longer utilized as fully as in previous years. Storage is only effective when there is something to store.

LIQUIFIED PETROLEUM GASES

Propane and butane (mostly the former) recovered in refining operations are shipped and stored under pressure in liquid form. To a considerable extent they are interchangeable as fuels with natural gas, and they have been the standby fuel for many consumers who have interruptible contracts for natural gas. The liquid form makes them readily transportable, and for this reason they are used extensively for mobile installations, seasonal spot uses (e.g., grain drying), and isolated facilities (cabins, rural residences). Their cost per Btu is high relative to natural gas, and in time other fuel shortages local supplies may be exhausted.

Underground storage in pressurized excavated space exists at four localities in Indiana and provides some cushion against both high seasonal demand and restricted shipment from refining centers. Product pipelines deliver LPG to the underground reservoirs and surface storage, thus improving delivery capacity in some parts of the state.

CRUDE OIL PRODUCTION IN INDIANA

Indiana's crude oil production is only a small proportion of the State's crude oil consumption (in terms of refinery products), although the exact percentage is difficult to assess because Indiana has a large refining industry, and very large volumes of crude oil are shipped into the State to yield refinery products most of which again go out-of-state. Whatever this ratio may be, Indiana's total known crude oil reserves of 22 million barrels can have little impact on the availability of refinery products within the State. Only significant new oil discoveries can alter this balance, and the discovery rate of recent years does not offer great hope for a change.

INDIANA'S ACCESS TO CRUDE OIL FROM OUT-OF-STATE

High prices and shortages due to restricted imports would appear to be the only limitations on the availability of crude oil to Indiana's refining industry. Oil enters the State principally via cross-country pipelines and a major and increasing part of the oil is from foreign sources. The crude oil supply to Indiana's largest refinery is nearly

40% foreign, closely paralleling the national situation. This supply is, of course, vulnerable to embargo. Much of the State is not dependent upon Indiana refineries for access to refinery products.

INDIANA COAL

Indiana has large reserves of coal (17 billion tons) and substantial annual production (about 25 million tons in 1974 and 1975), but nearly twice as much coal is consumed annually as is produced in the State. Table 2 contains information regarding Indiana coal reserves. The State's consumption profile is contained to Appendix A for both 1974 and 1975. Approximately 5 million tons of Indiana coal are shipped out-of-state annually, which means that over half of the coal consumed in imported. The reasons, in addition to the fact that the State's annual consumption exceeds the annual capacity, are that 1) Indiana ranked second nationally in 1975 in steel production and all metallurgical coking coal must be imported, and 2) the sulfur content in much of Indiana's coals currently required that they be blended with lower sulfur coals for use in electrical generation. Indiana coal production could be increased about 1 million tons annually for a number of years, a rate already planned by producers for the next 3 to 5 years.

CONJECTURAL SOURCES OF ADDITIONAL FUELS

Gas from shale and from coal, oil from oil shale, and uranium have received some attention as possible future supplements to Indiana's energy supply.

Natural gas has been produced in modest amounts at a few localities in Indiana from the rock unit called the New Albany Shale, which underlies extensive areas. The Indiana Geological Survey is participating in a broad, multi-state investigation of the shale gas possibilities, supported by the Energy Research and Development Administration. Shale gas wells, if favorable conditions for production are found, will have relatively low individual yield, although the total volume ultimately recovered could be appreciable.

Methane can be removed from bituminous coal in advance of underground mining as a safety measure. The shortage of natural gas combined with increasing prices suggests that demethanization could reach the level of commercial gas production in some regions. The Indiana Geological Survey, in cooperation with the U.S. Bureau of Mines, is testing Indiana coals for methane yield. Early results suggest that the expectable gain in gas supply will be modest even if such development materializes.

The same New Albany Shale that is a possible source for additional natural gas is also classified as a low-grade oil shale and, in addition, contains some uranium. The oil yield in gallons per ton is substantially below the level that is now considered commercial, only 8 to 14 gallons per ton from the richest parts of the formation compared with the minimum yield for economic operation for the Colorado Shales of about 25 gallons per ton. The most radioactive part of the New Albany Shale tested to date is about 0.01 percent U_3O_8 equivalent, in comparison with about 0.2 percent for the current minimum commercial grades. Even this disparity does not tell the whole story, however, as much of the "U_3O_8 equivalent" reflects potassium in the clay minerals, rather than uranium or even thorium. Evaluation of both shale oil and nuclear fuel possibilities must consider, however, the enormous tonnages of New Albany shale that underlie Indiana and other parts of the Midwest.

COAL CONVERSION

Both gaseous and liquid products that would be satisfactory substitutes for natural gas and certain refinery products can be produced from coal of the type that constitutes Indiana's principal reserves. These methods of utilizing coal have the advantage that sulfur removal from the products is more readily accomplished than from the coal itself, making possible more environmentally sound utilization of Indiana's high-sulfur coals. Processing plants of commercial size are very costly, and only pilot or experimental installations are in operation or under construction, and acceptable sites in Indiana would be largely restricted to the Ohio River region. Despite the high costs and other handicaps, coal conversion is probably the best means for the United States to attain a satifactory level of domestic security in liquid and gaseous fuels. Some research on coal conversion, federally supported, is currently underway within the State.

LOW-BTU GAS

Gas that has a BTU content considerably lower than that of pipeline gas (300 to 400 BTU per cubic foot as compared with pipeline natural gas at 1,000 to 1,100 BTU per cubic foot) can be manufactured readily from coal and was indeed the gaseous fuel of the Midwest in the years between the depletion of the early natural gas fields and the coming of the long-distance interstate pipelines from the western and southwestern states and the Gulf of Mexico. The technology is known, and suitable coal is available, for production of low-BTU gas in significant volume, although major production capacity is not in place at this time. Such substitute gas is considered less desirable than natural gas and is less suited to

TABLE 2

RECOVERABLE COAL RESERVES IN INDIANA BY COUNTY, JANUARY, 1, 1974[1]

County	Strippable	Non-Strippable	TOTAL
Clay	312,770,247	252,366,000	565,136,247
Daviess	137,005,877	119,502,000	256,507,877
Dubois	4,803,000	3,981,000	8,784,000
Fountain) Warren)	32,446,705	3,603,000	36,049,705
Gibson	-	2,230,905,992	2,230,905,992
Greene	193,619,319	228,181,472	421,800,791
Knox	142,285,000	2,241,335,016	2,383,620,016
Martin	82,771,000	11,000	82,782,000
Owen	49,533,774	-	49,533,774
Parke	9,526,877	29,402,000	38,928,877
Perry	-	28,200,000	28,200,000
Pike	215,199,514	370,015,945	585,215,459
Posey	-	2,870,391,000	2,870,391,000
Spencer	52,140,749	-	52,140,749
Sullivan	290,478,626	3,482,373,446	3,772,852,072
Vanderburgh	-	1,083,454,000	1,083,454,000
Vermillion	37,157,280	295,399,205	332,556,485
Vigo	253,918,457	1,448,483,408	1,702,401,865
Warrick	257,942,501	517,134,269	775,076,770
TOTAL	2,071,598,926	15,205,738,753	17,276,337,679

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[1] Modified from Table 6, Page 33, Coal Resources of Indiana, Bulletin 42-I, Indiana Geological Survey (thru Jan. 1, 1965) with Annual Reports of Indiana Bureau of Mines and U.S. Bureau of Mines, 1965 through 1973. Based on recovery by current technology.

pipeline delivery except over short distances. This lower desirability factor may be expected to prevail until the first cold day after the natural gas supplies become inadequate.

CHAPTER 3

SUGGESTIONS FOR POLICY

No single answer exists to the problems associated with the impending and projected shortages of energy, whether these be the immediate shortfalls in natural gas or those that will certainly occur among some of the other energy resources consumed in our economy. The potential contributions from many alternative sources must be explored with no guarantees of success. Our situation is such that no possible contributor, the small and improbable as well as the large and apparently obvious, can be ignored without peril. It is also critically important to realize that many potentially significant solutions should receive action now in order to have effects on our State's energy supplies beyond 1980. With these points in mind, the panel makes the following suggestions for policy consideration. These suggestions represent a consensus on each point; being different individuals with differing priority concerns, not all members subscribed to all suggestions.

1. Energy Conservation

While it is not certain to what extent energy consumption may be decoupled from gross national product, good energy conservation practices appear to offer an excellent economical immediate method of counteracting projected shortages of natural gas and petroleum without markedly affecting lifestyles. A considerable relaxation of the conservation efforts of 1973-74 has apparently occurred, and indications are that much of the expected near-term energy shortages and economic impacts could be offset by a renewed and continuing program to educate the public regarding the wisdom of saving energy. A very recent analysis by the International Energy Agency (IEA) shows the U.S. energy conservation effort to be among the worst in the IEA countries. Recognizing that implementation of conservation strategies must be monitored carefully to avoid adverse economic impacts, the State of Indiana could be among the nation's leaders in this area by adoption of the following:

(i) Provide authoritative energy conservation information and an active state-wide program for disseminating it.

(ii) Consider a program of tax incentives to encourage conservation including, but not limited to, rebates for retrofitting existing structures with high efficiency insulation, property tax allowance for similar installations in new structures, and reduced assessments for passenger cars with smaller engines.

(iii) Encouragement of energy-conserving new construction, setting an example by moving to maximize the energy efficiency of State-owned buildings and by requiring that new buildings funded entirely or in part by State funds utilize the best available energy-conserving designs and technologists including solar energy supplementation. Introduction of new building codes such as ASHRAE 90-75 is recommended.

(iv) Development of a technology transfer network throughout Indiana to facilitate the transfer of energy conservation knowledge to end users.

(v) Strict enforcement of the 55 mile-per-hour speed limit on Indiana highways.

(vi) Implementation of appropriate incentive programs to encourage recycling of energy-intensive and petroleum-based materials.

(vii) Thorough consideration of the phase-out of one-way beverage containers as an energy conservation action.

(viii) Analysis of alternative electricity rate structures to determine their conservation impacts.

2. Solar Energy

The potential cited earlier for solar energy utilization within Indiana supports the following recommendations:

(i) Indiana's pioneering solar energy property tax reduction law should be widely publicized in the State.

(ii) The State of Indiana should determine and establish a realistic goal for the percentage of new construction to involve solar heating and air conditioning by 1980, with a similarly developed objective set for the percentage of all space heating and cooling that should be provided by solar means by 1985.

(iii) Solar energy information centers should be developed (perhaps a part of the network suggested in 1. (iv) above). These centers would provide architects, builders, savings and loan associations, banks, industrial and residential consumers, trade unions, and others with technical information on solar energy applications.

(iv) The State should play an active role in attracting demonstration funds for solar energy from ERDA and HUD to Indiana.

(v) Indiana should develop further the existing network of solar monitoring stations for data collection.

(vi) An active State-wide program should be implemented to educate the public on solar energy. This program would include the production of authoritative literature whose major purpose would be to inform the consumers on the following: (a) give consumers enough understanding to permit them to recognize accuracy of perfomance claims of solar equipment manufacturers; (b) give consumers enough background to make personal decisions in regard to their own best use of solar energy; (c) provide technical information that will make it possible for "do it yourself" individuals to go ahead on their own and build solar collecting equipment.

3. Electrical Power

Announced generating capacity expansion plans within ECAR over the next ten years prompts the following suggestions for policy consideration:

(i) A prudent policy for both Indiana and the nation is to recognize the constraints to building additional coal-fired and nuclear capacity, and to make every effort to resolve the many problems involved in order that the utility companies may find it possible to install more capacity than is currently planned, and to do so with minimal environmental impact.

(ii) Utilities should be encouraged to explore the potential for lower facility construction costs through energy storage installations, e.g., pumped storage, underground compressed air, or thermal storage.

4. Coal

Following completion of the large interstate gas pipelines in the 1950s, Indiana consumers along with those in most of the midwestern and northeastern states responded to economic incentives and shifted a significant portion of their energy consumption to natural gas produced in the

South and Southwest. As supplies from those areas begin to decline, it appears that a most important alternative available to the State is its large coal reserves. Gasification to produce both high and low Btu gas from coal offers direct substitution for natural gas. Additional means of utilizing coal efficiently with due recognition of environmental constraints need active study. These points support the following policy recommendations:

(i) The State should make immediate, vigorous efforts to develop gasification projects for both high and low Btu gas at scales sufficient to relieve impending pressures that will surely result as future interstate natural gas curtailments spread more deeply into the Indiana economy.

(ii) The State should carefully consider the advisability of a State tax on all future coal mined. The returns should be applied, under legislative authority, to a trust fund for research, development, and demonstration of gasification, liquifaction, and desulfurization of Indiana coals for use in Indiana homes, businesses, and industries. A one percent tax on Indiana's 1975 coal production of 25,269,000 tons with an average minehead value of $11.25 per ton would raise $2,840,000 for this purpose.